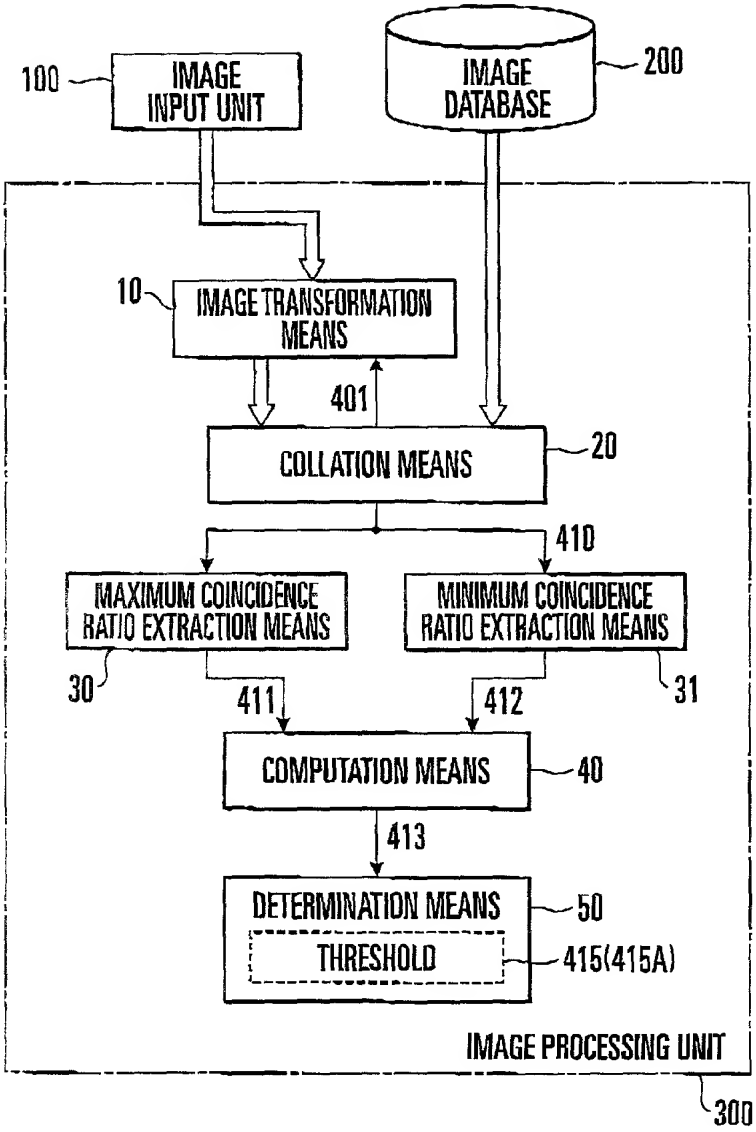

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
10
IMAGE TRANSFORMATION MEANS
401
COLLATION MEANS
20
410
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
30
31
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415(415A)
IMAGE PROCESSING UNIT
300

FIG. 1

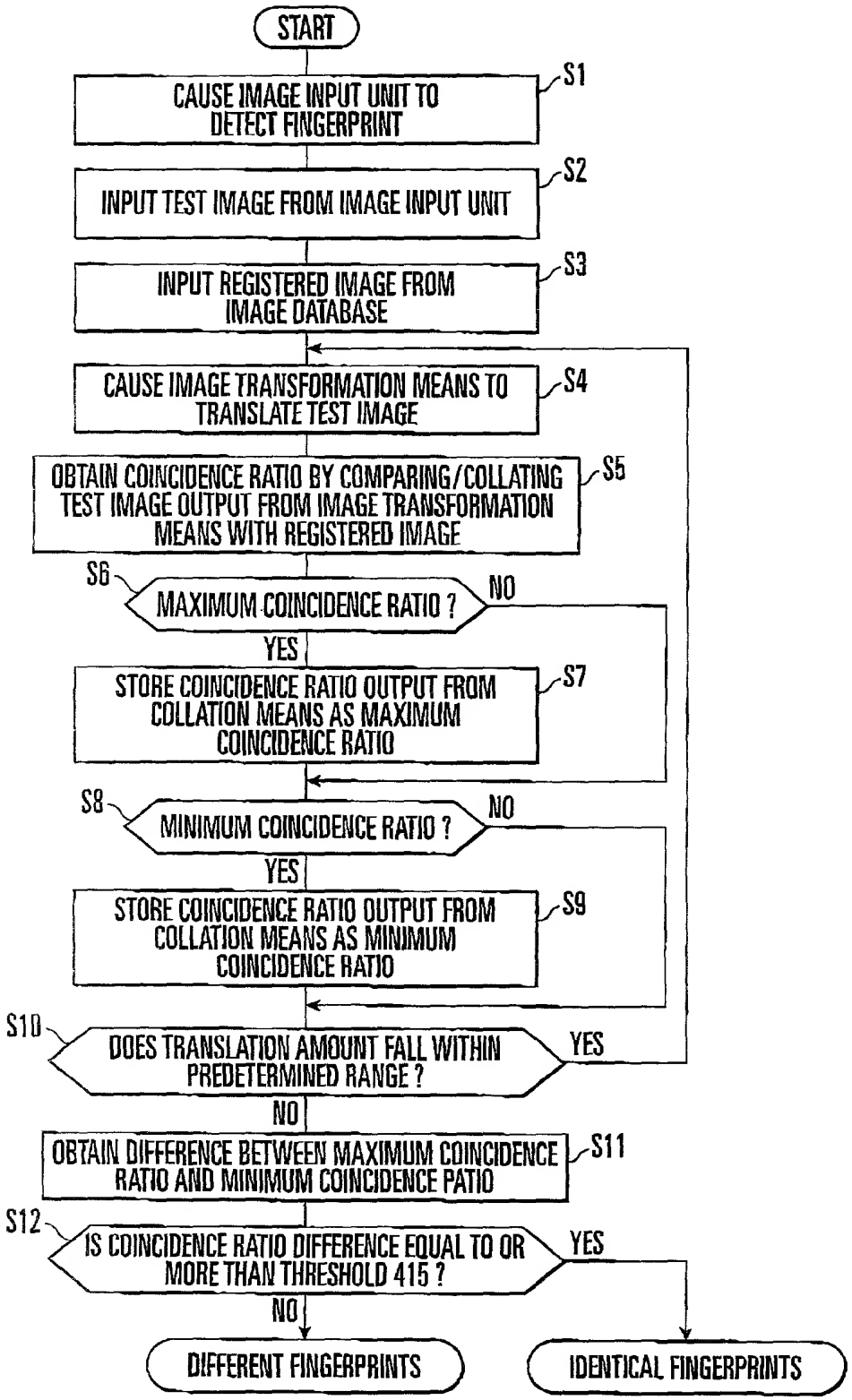

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S4
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE
S5
S6
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MAXIMUM COINCIDENCE RATIO
S7
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE PATIO
S11
S12
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR MORE THAN THRESHOLD 415 ?
YES
NO
DIFFERENT FINGERPRINTS
IDENTICAL FINGERPRINTS

FIG. 2

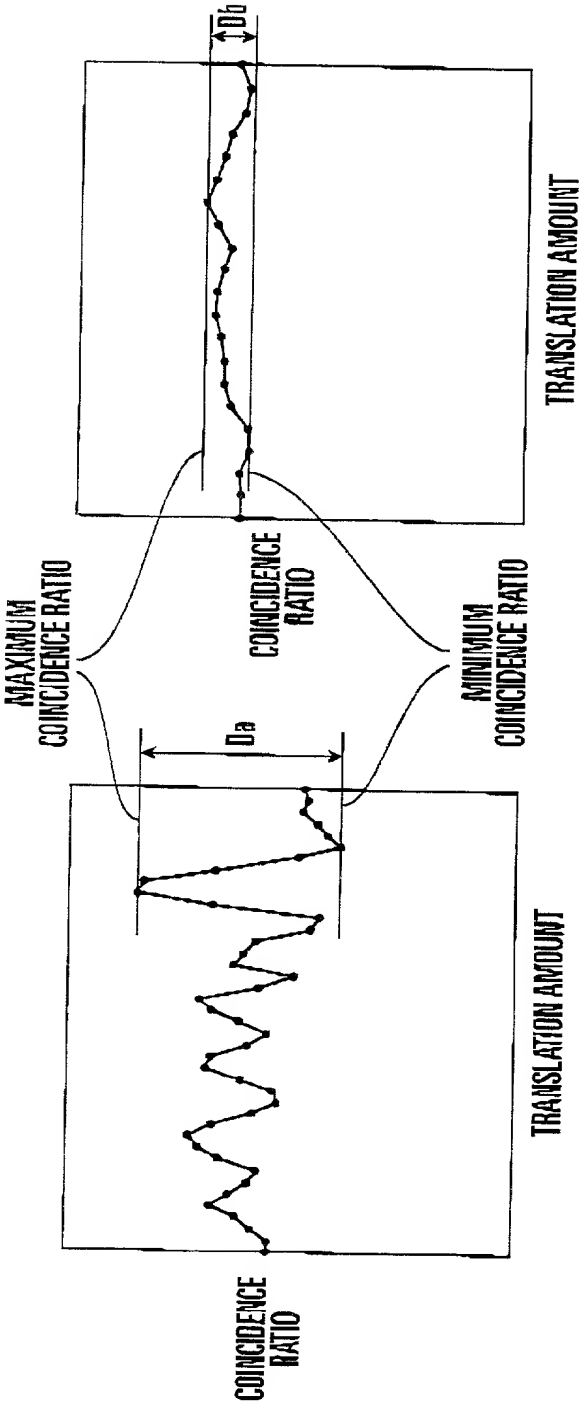

Db
MAXIMUM COINCIDENCE RATIO
COINCIDENCE RATIO
MINIMUM COINCIDENCE RATIO
Da
TRANSLATION AMOUNT
TRANSLATION AMOUNT
COINCIDENCE RATIO

FIG.3A

FIG.3B

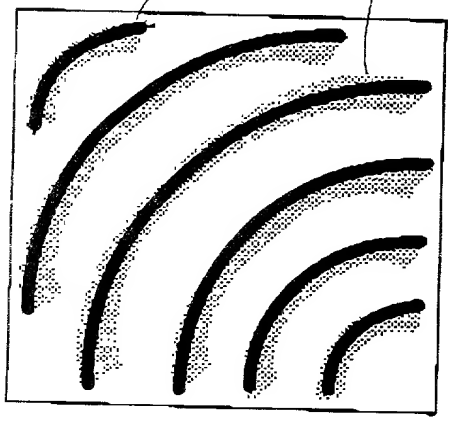


FIG.4A

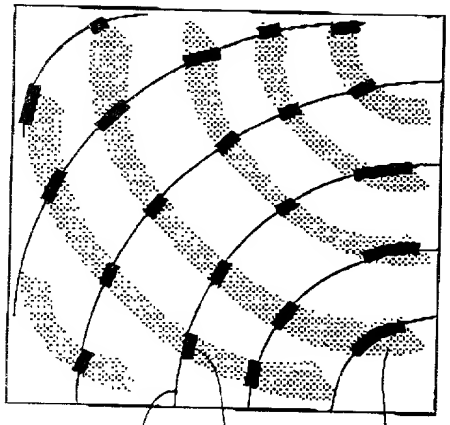


FIG.4C

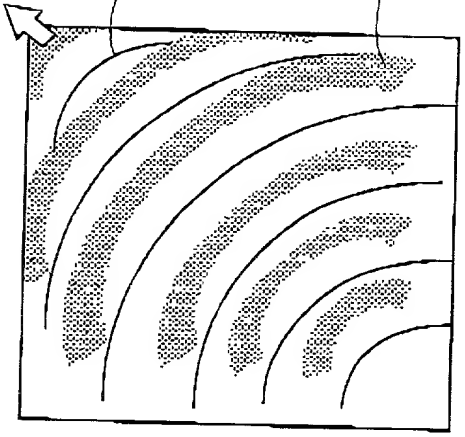


FIG.4B

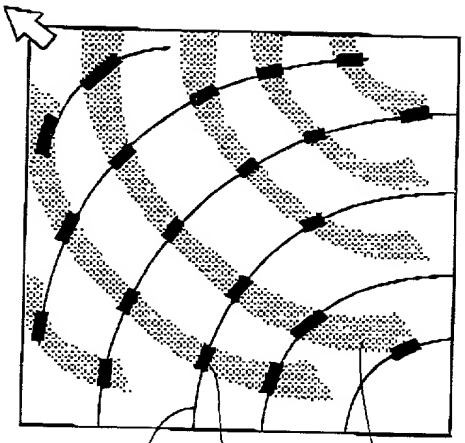


FIG.4D

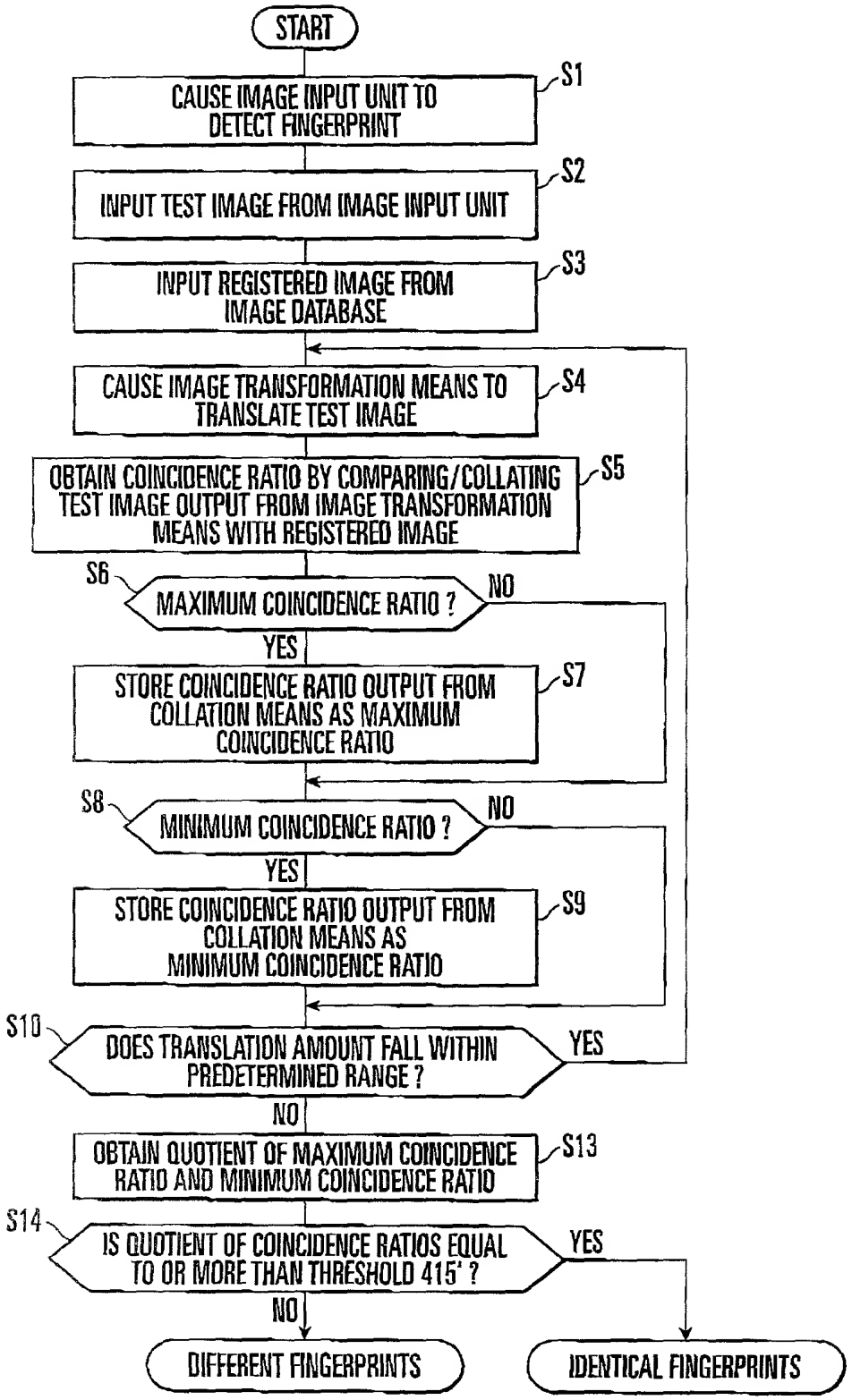


FIG. 5

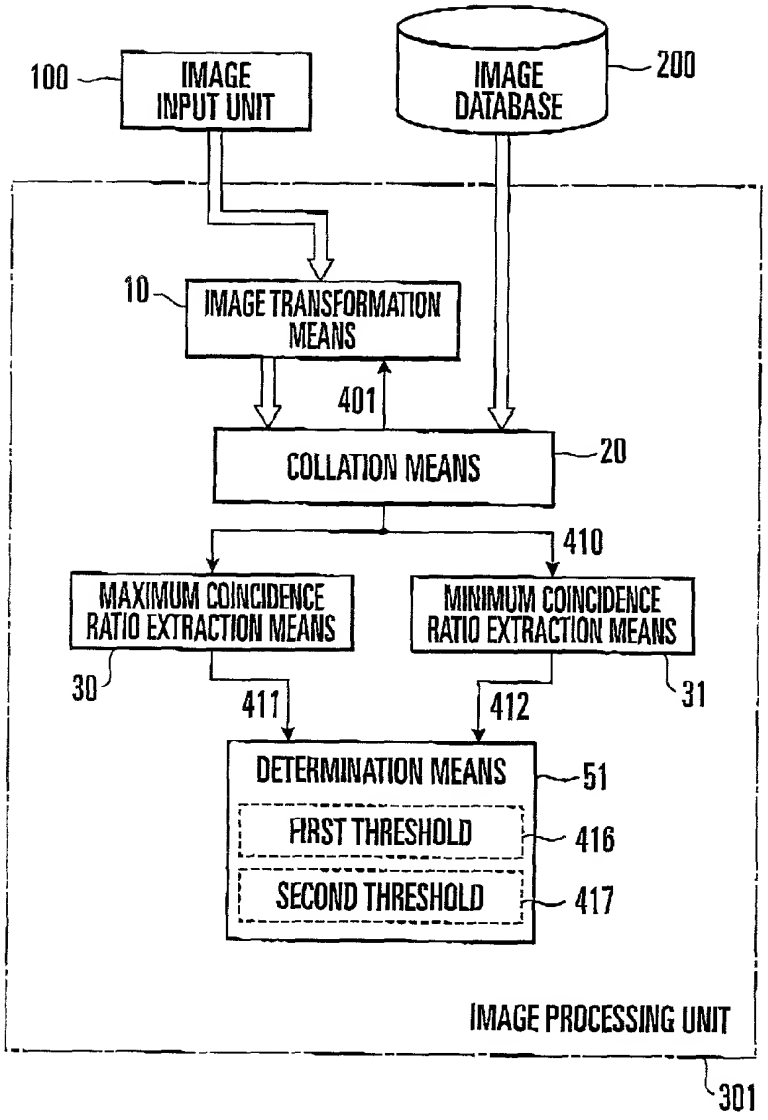

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
10
IMAGE TRANSFORMATION MEANS
401
COLLATION MEANS
20
410
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
30
31
411
412
DETERMINATION MEANS
51
FIRST THRESHOLD
416
SECOND THRESHOLD
417
IMAGE PROCESSING UNIT
301

FIG. 6

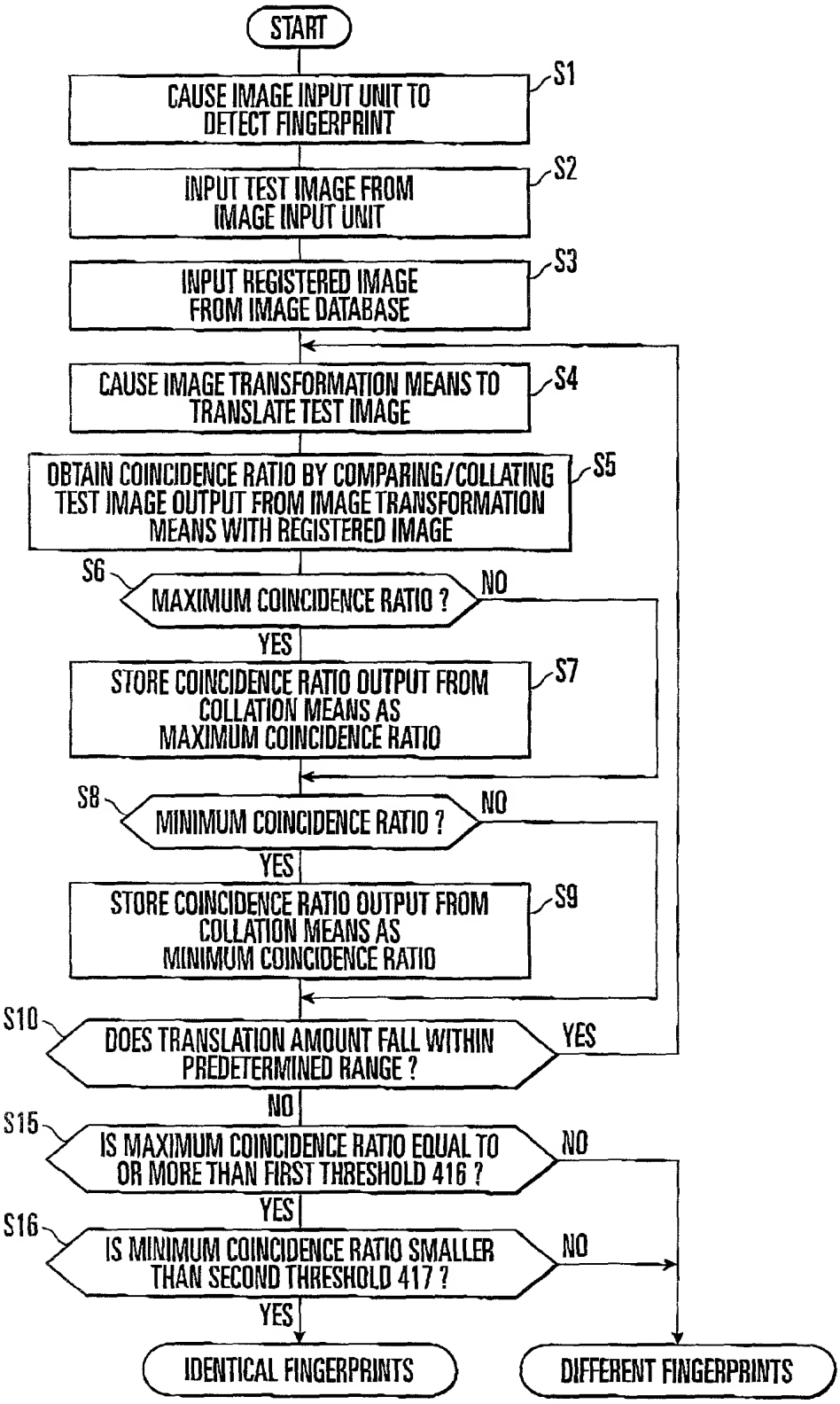


FIG. 7

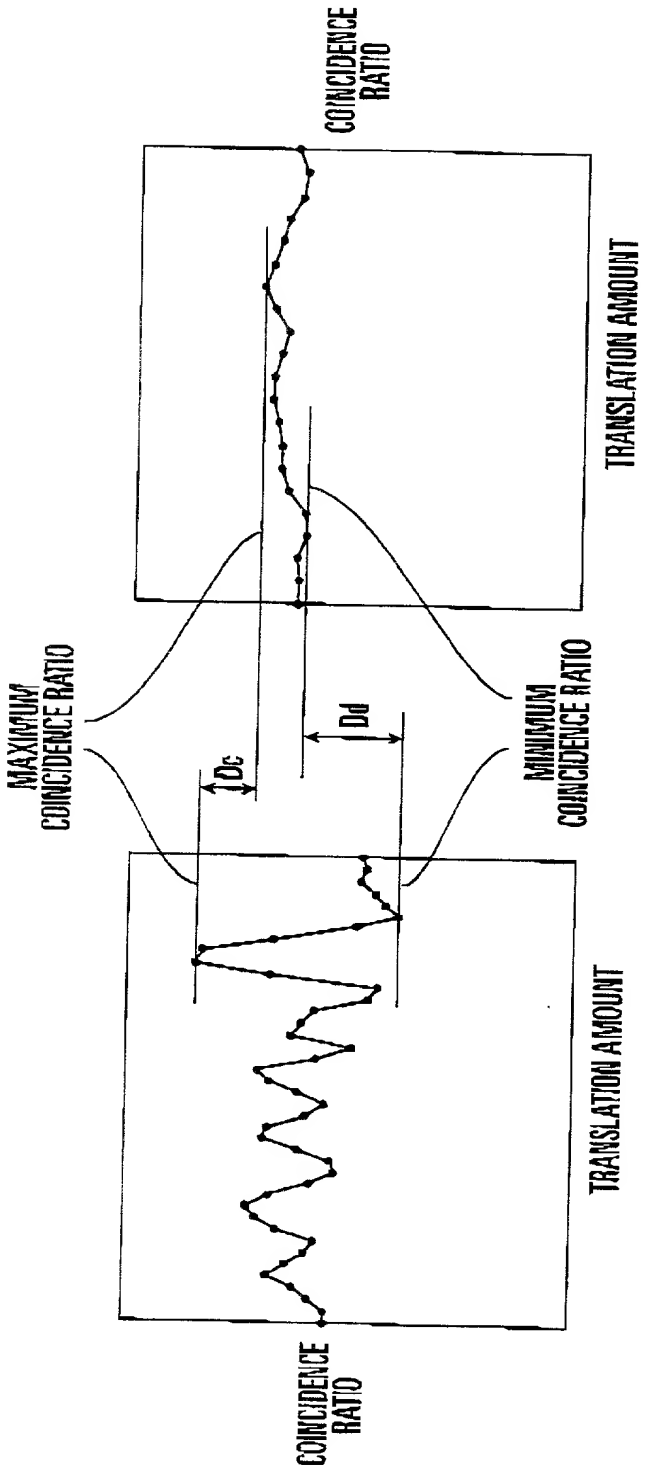

COINCIDENCE RATIO
TRANSLATION AMOUNT
MAXIMUM COINCIDENCE RATIO
MINIMUM COINCIDENCE RATIO
Dc
Dd
COINCIDENCE RATIO
TRANSLATION AMOUNT

FIG.8A

FIG.8B

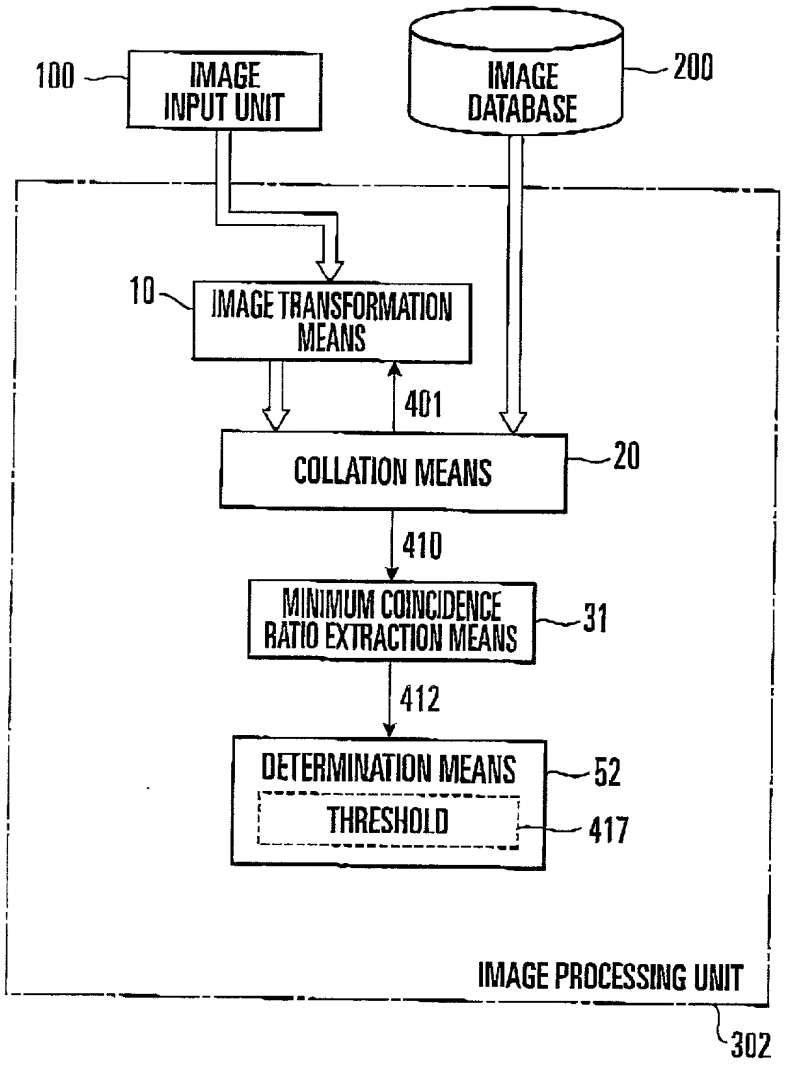


FIG. 9

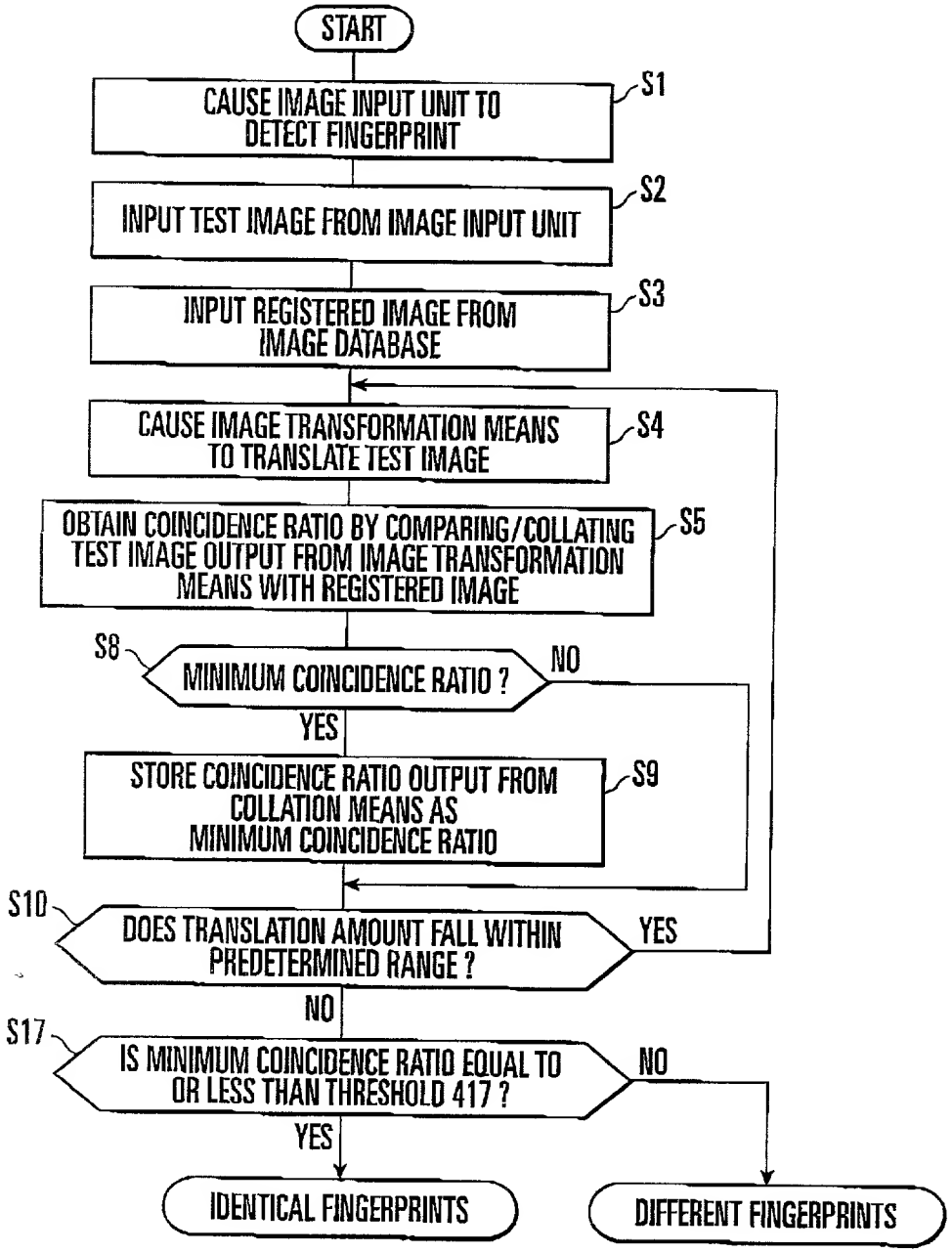

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S4
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE
S5
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
S17
IS MINIMUM COINCIDENCE RATIO EQUAL TO OR LESS THAN THRESHOLD 417 ?
NO
YES
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG. 10

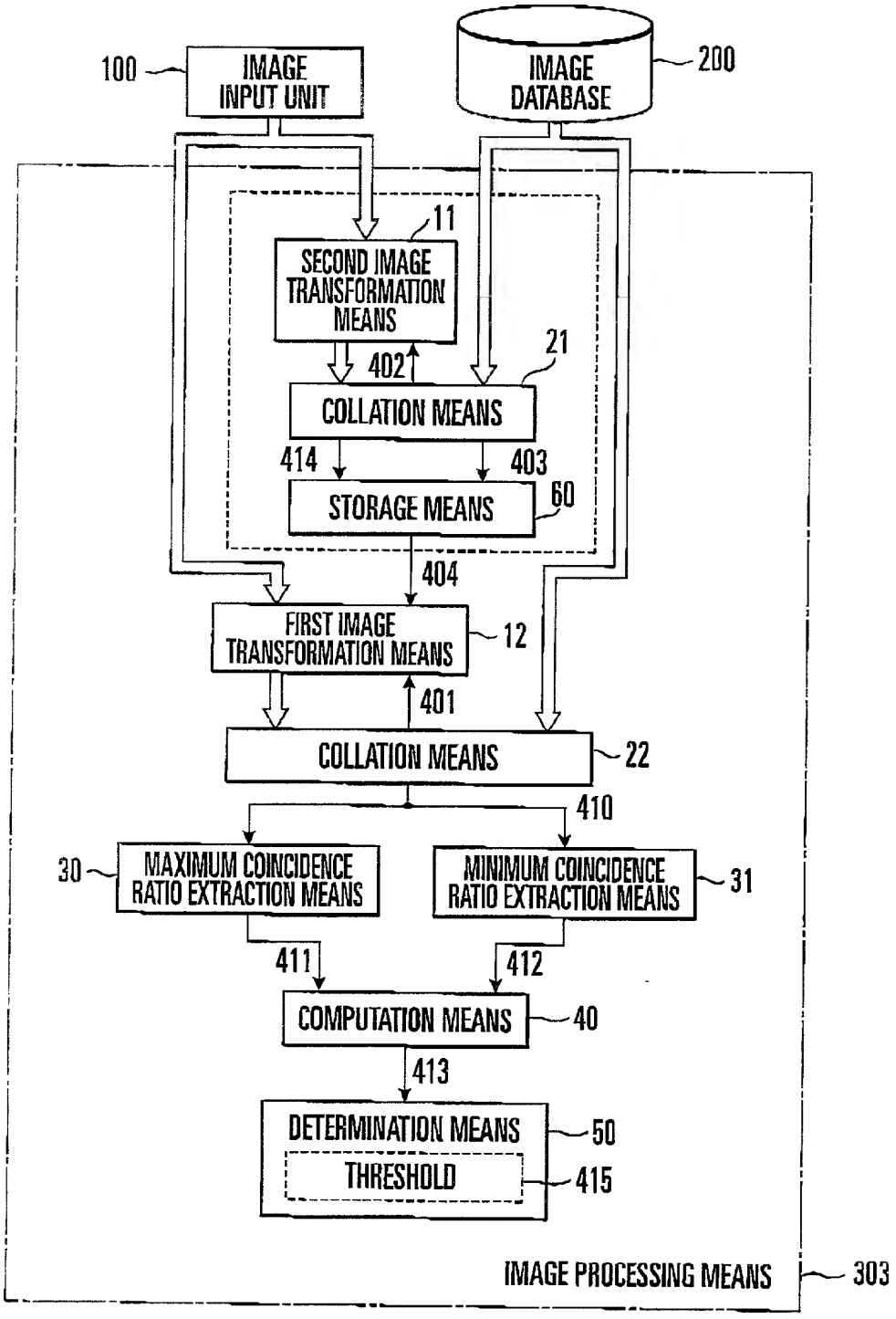

100
IMAGE INPUT UNIT
200
IMAGE DATABASE
11
SECOND IMAGE TRANSFORMATION MEANS
402
21
COLLATION MEANS
414
403
STORAGE MEANS
60
404
FIRST IMAGE TRANSFORMATION MEANS
12
401
COLLATION MEANS
22
410
30
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING MEANS
303

FIG. 11

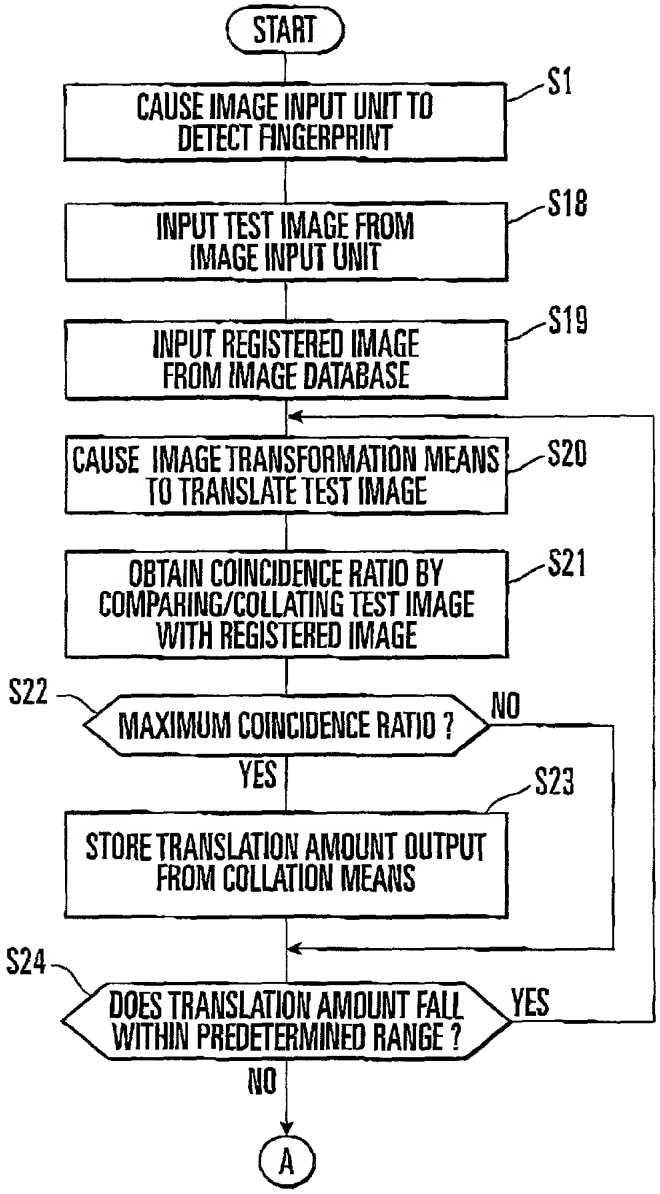


FIG. 12A

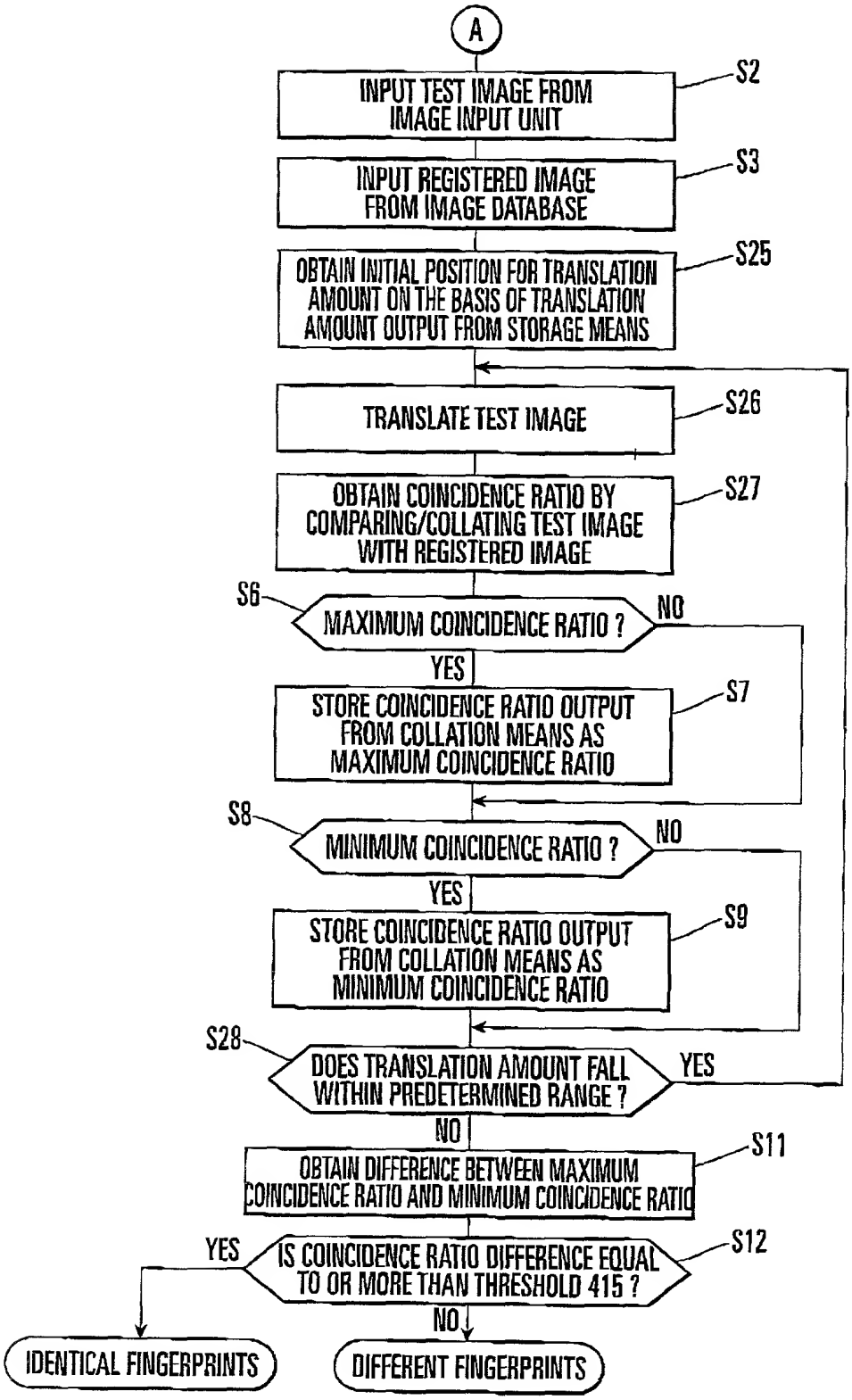


FIG. 12B

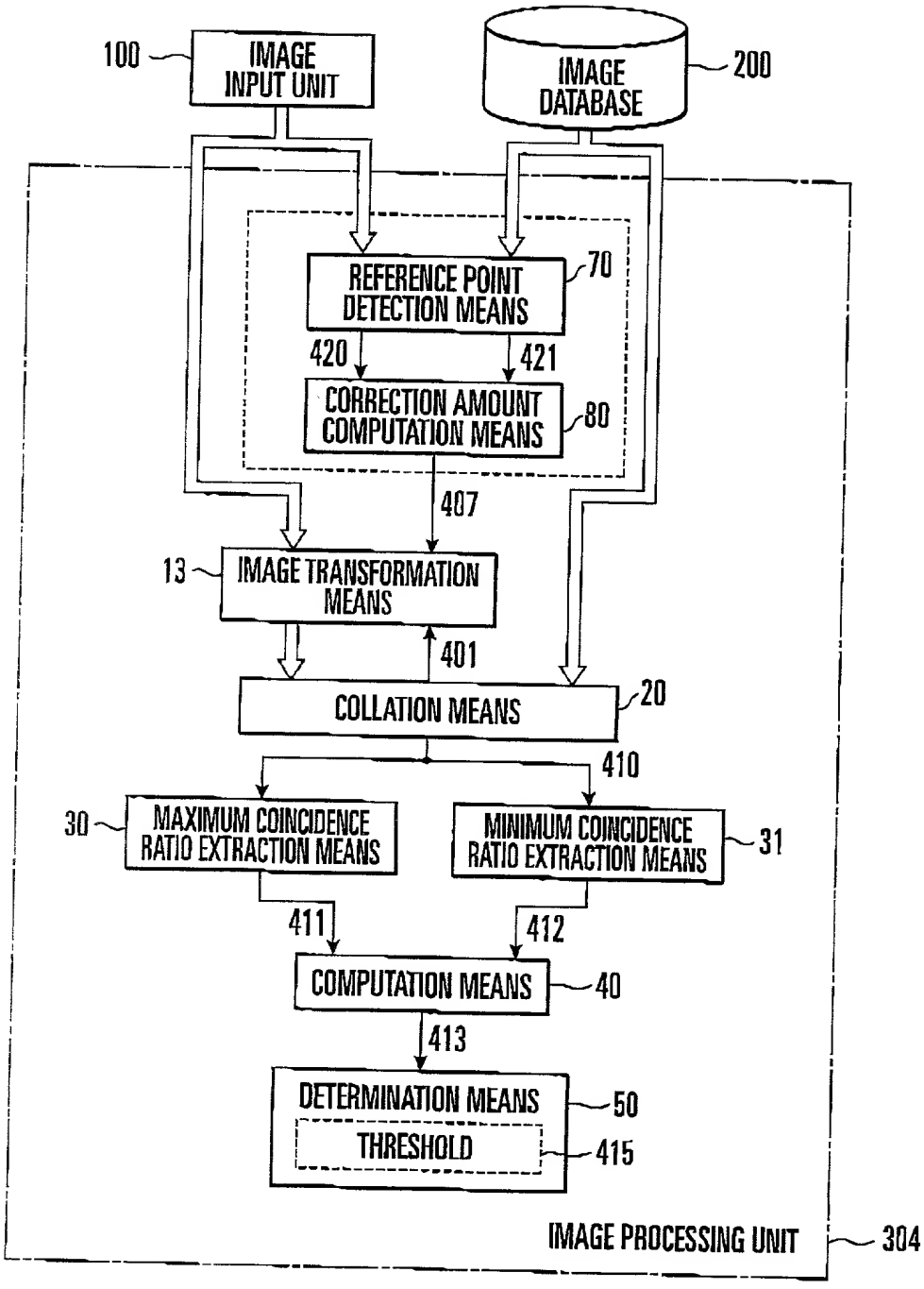

100
IMAGE INPUT UNIT
200
IMAGE DATABASE
REFERENCE POINT DETECTION MEANS
70
420
421
CORRECTION AMOUNT COMPUTATION MEANS
80
407
13
IMAGE TRANSFORMATION MEANS
401
COLLATION MEANS
20
410
30
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
304

FIG. 13

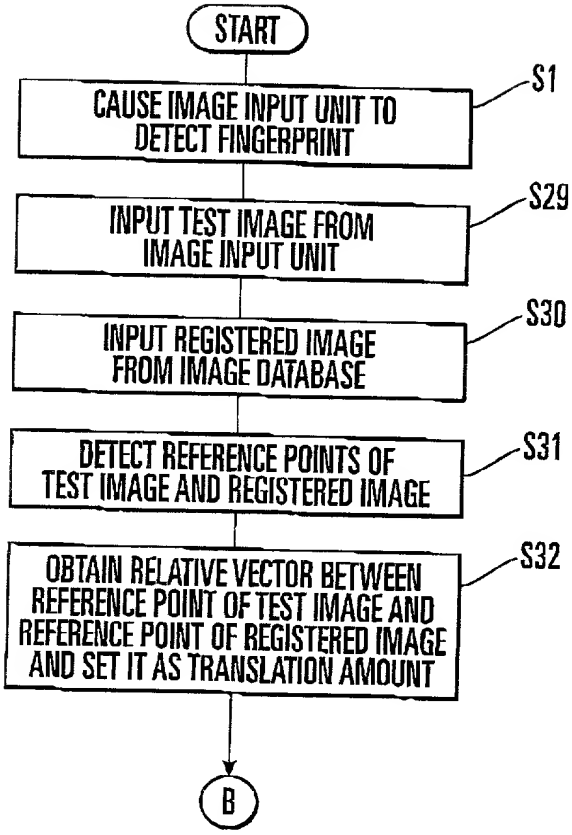


FIG. 14A

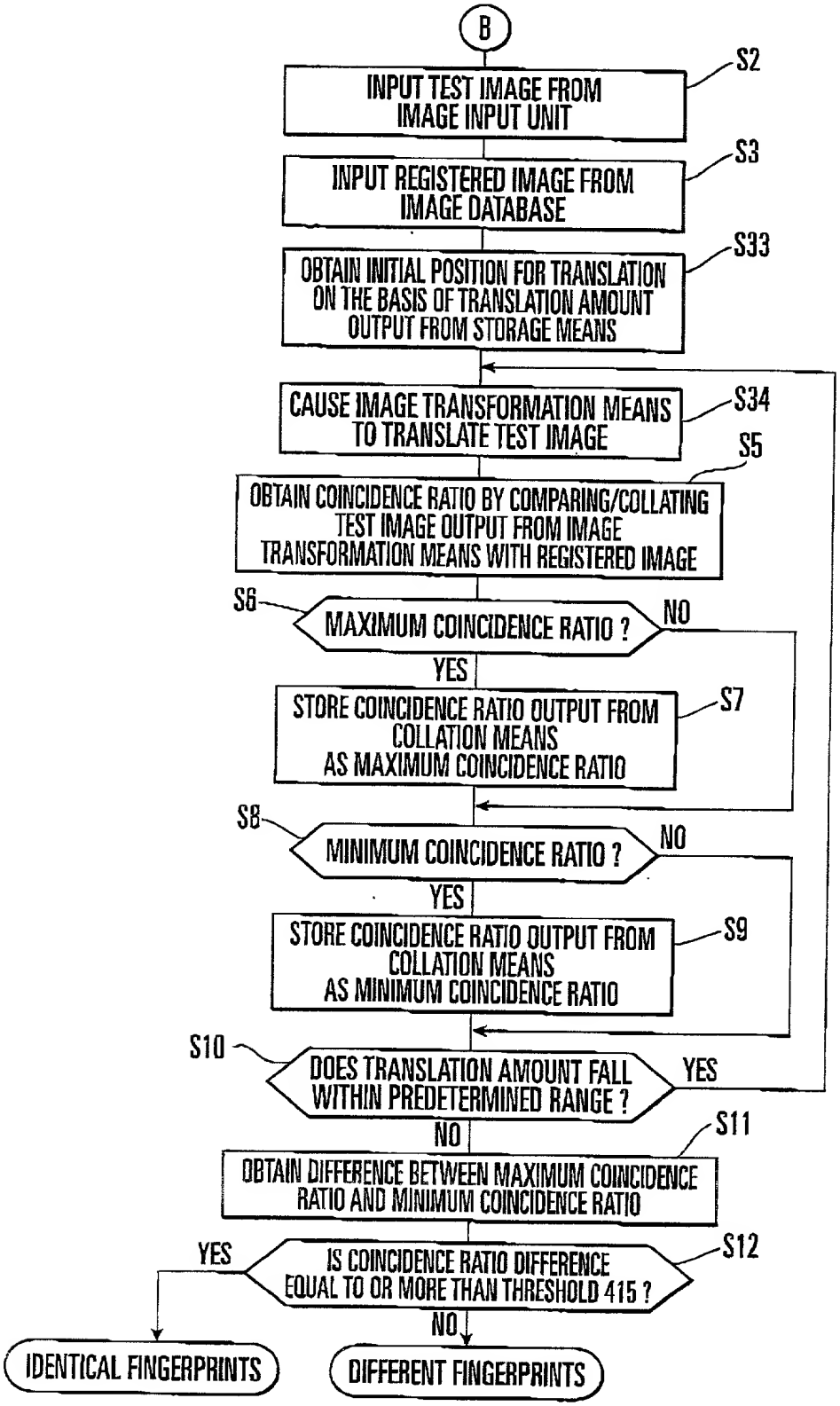

B
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
OBTAIN INITIAL POSITION FOR TRANSLATION ON THE BASIS OF TRANSLATION AMOUNT OUTPUT FROM STORAGE MEANS
S33
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S34
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE
S5
S6
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MAXIMUM COINCIDENCE RATIO
S7
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO
S11
YES
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR MORE THAN THRESHOLD 415 ?
S12
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG. 14B

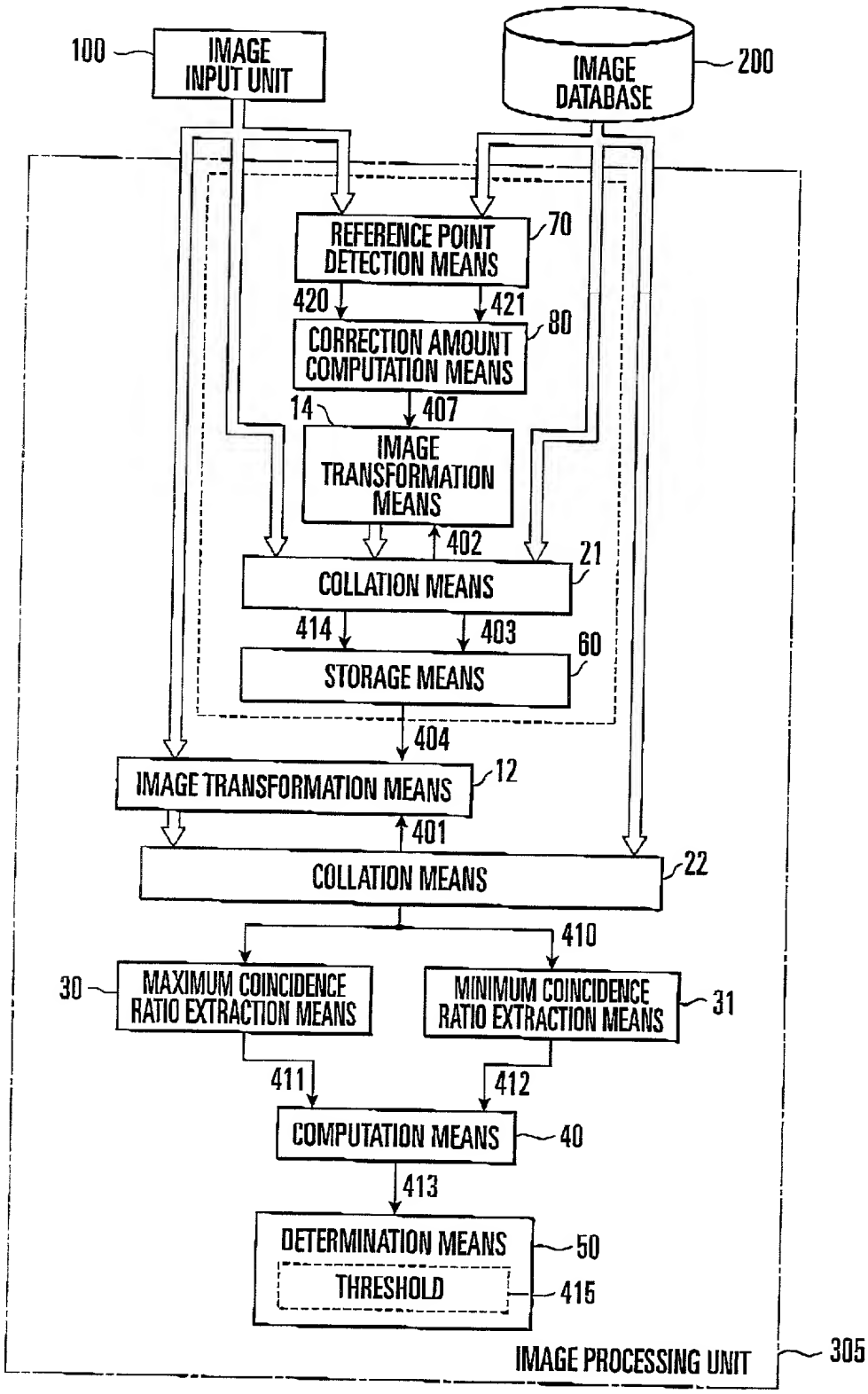

100
IMAGE INPUT UNIT
200
IMAGE DATABASE
REFERENCE POINT DETECTION MEANS
70
420
421
CORRECTION AMOUNT COMPUTATION MEANS
80
14
407
IMAGE TRANSFORMATION MEANS
402
21
COLLATION MEANS
414
403
60
STORAGE MEANS
404
IMAGE TRANSFORMATION MEANS
12
401
COLLATION MEANS
22
410
30
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
305

FIG. 15

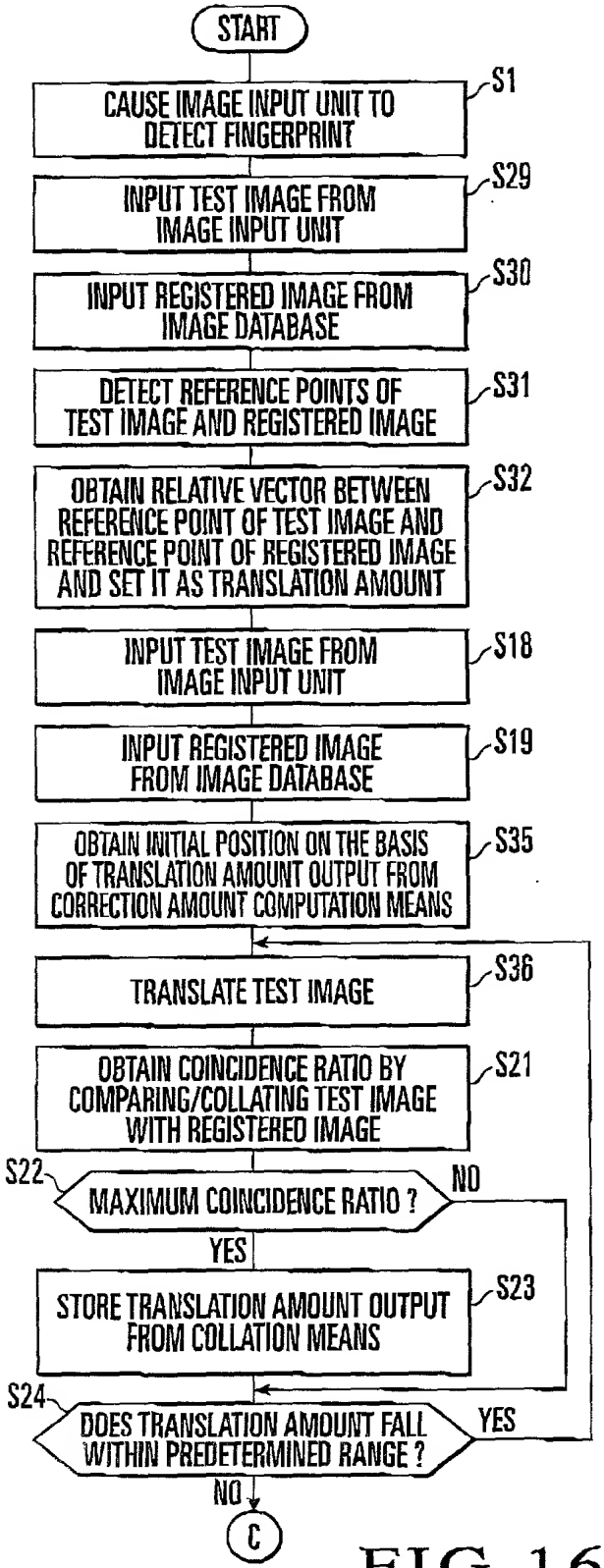

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S29
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S30
DETECT REFERENCE POINTS OF TEST IMAGE AND REGISTERED IMAGE
S31
OBTAIN RELATIVE VECTOR BETWEEN REFERENCE POINT OF TEST IMAGE AND REFERENCE POINT OF REGISTERED IMAGE AND SET IT AS TRANSLATION AMOUNT
S32
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S18
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S19
OBTAIN INITIAL POSITION ON THE BASIS OF TRANSLATION AMOUNT OUTPUT FROM CORRECTION AMOUNT COMPUTATION MEANS
S35
TRANSLATE TEST IMAGE
S36
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S21
S22
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE TRANSLATION AMOUNT OUTPUT FROM COLLATION MEANS
S23
S24
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
C

FIG.16A

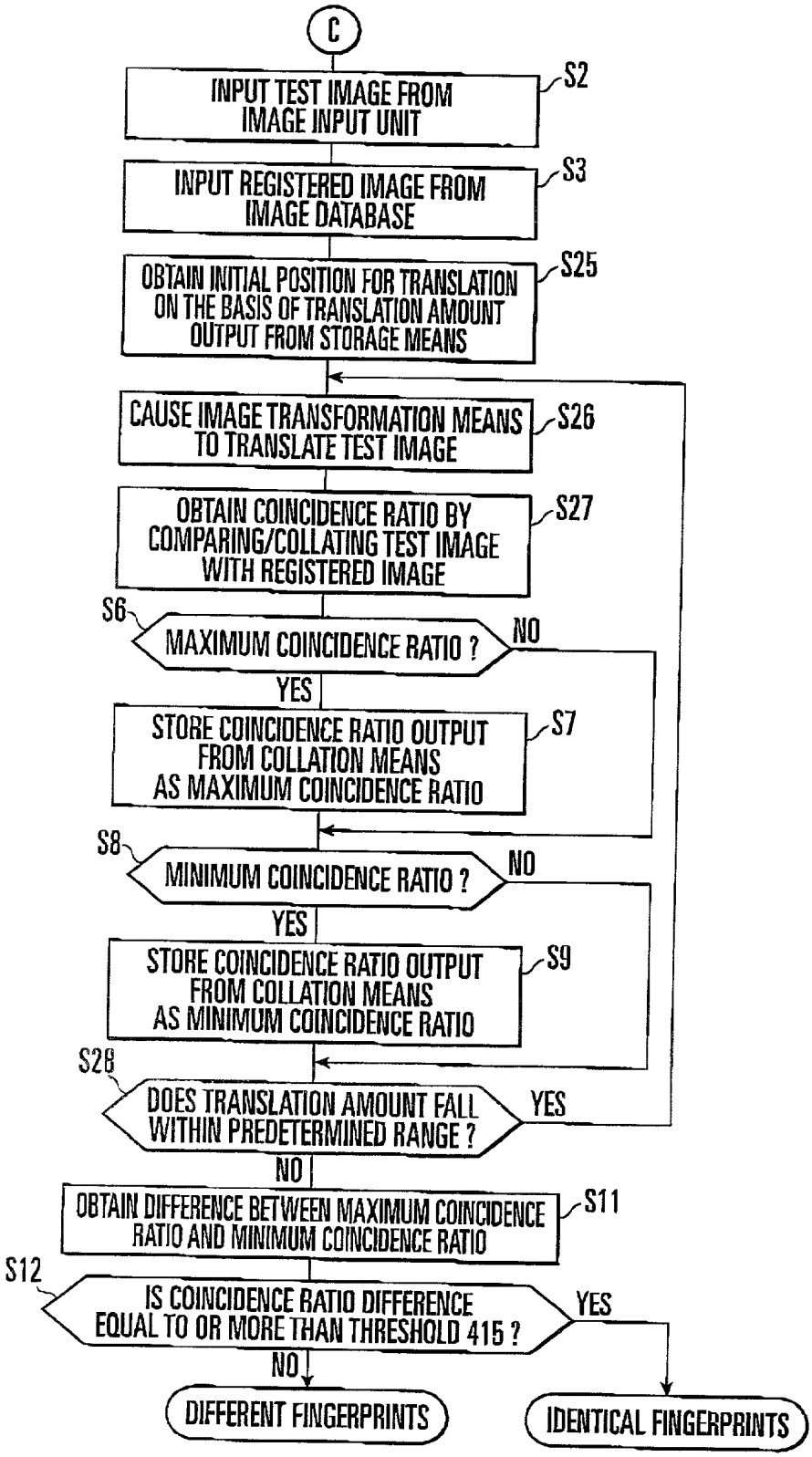

C
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
OBTAIN INITIAL POSITION FOR TRANSLATION ON THE BASIS OF TRANSLATION AMOUNT OUTPUT FROM STORAGE MEANS
S25
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S26
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S27
S6
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MAXIMUM COINCIDENCE RATIO
S7
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S28
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO
S11
S12
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR MORE THAN THRESHOLD 415 ?
YES
NO
DIFFERENT FINGERPRINTS
IDENTICAL FINGERPRINTS

FIG. 16B

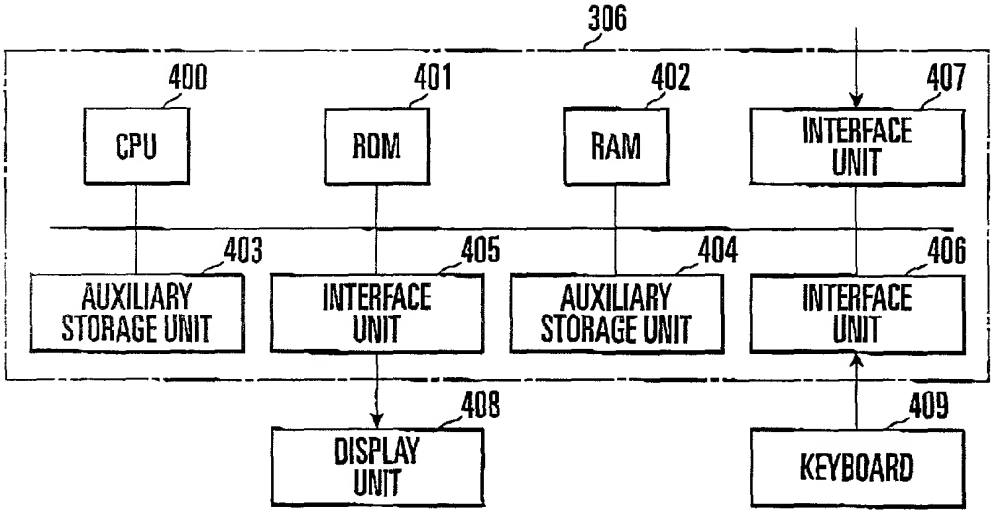

306
400
CPU
401
ROM
402
RAM
407
INTERFACE UNIT
403
AUXILIARY STORAGE UNIT
405
INTERFACE UNIT
404
AUXILIARY STORAGE UNIT
406
INTERFACE UNIT
408
DISPLAY UNIT
409
KEYBOARD

FIG. 17

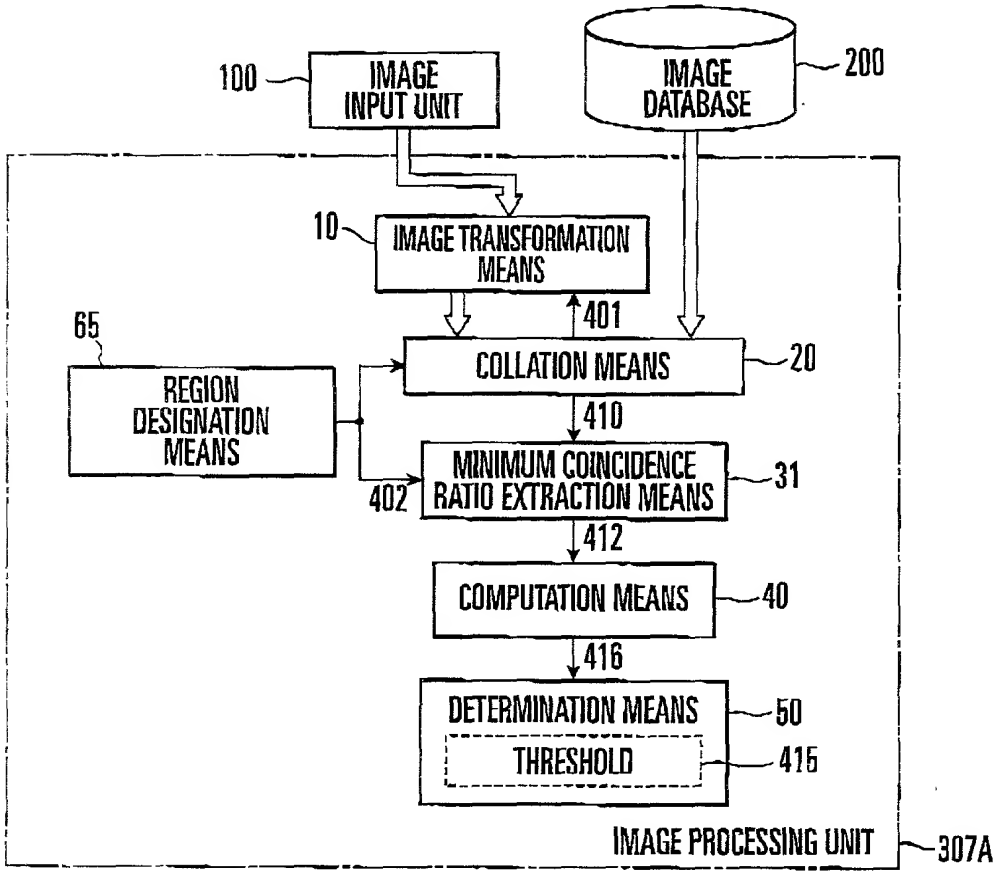

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
10
IMAGE TRANSFORMATION MEANS
401
65
REGION DESIGNATION MEANS
COLLATION MEANS
20
410
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
402
412
COMPUTATION MEANS
40
416
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
307A

FIG. 18

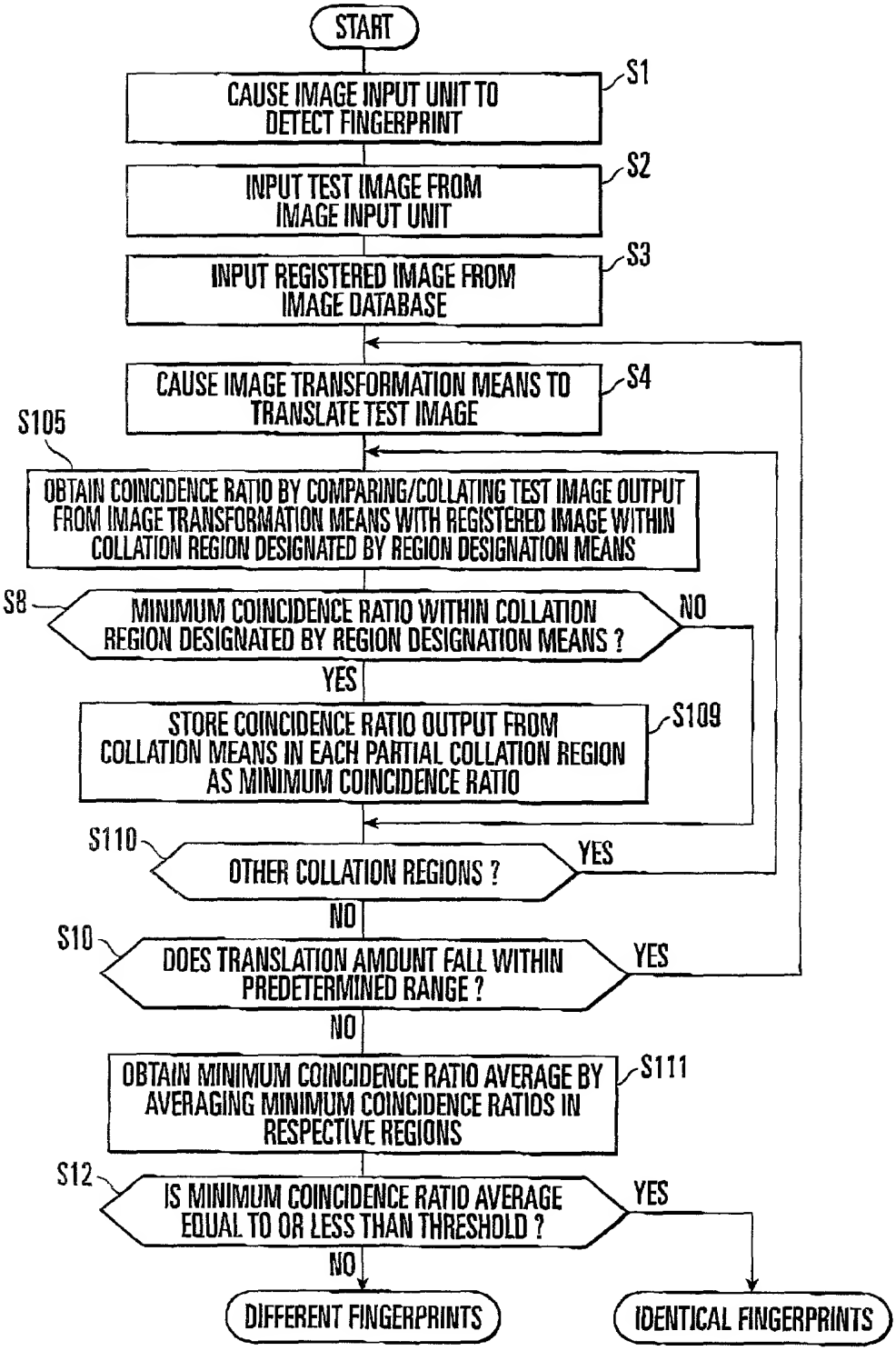

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S4
S105
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE WITHIN COLLATION REGION DESIGNATED BY REGION DESIGNATION MEANS
S8
MINIMUM COINCIDENCE RATIO WITHIN COLLATION REGION DESIGNATED BY REGION DESIGNATION MEANS ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS IN EACH PARTIAL COLLATION REGION AS MINIMUM COINCIDENCE RATIO
S109
S110
OTHER COLLATION REGIONS ?
YES
NO
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN MINIMUM COINCIDENCE RATIO AVERAGE BY AVERAGING MINIMUM COINCIDENCE RATIOS IN RESPECTIVE REGIONS
S111
S12
IS MINIMUM COINCIDENCE RATIO AVERAGE EQUAL TO OR LESS THAN THRESHOLD ?
YES
NO
DIFFERENT FINGERPRINTS
IDENTICAL FINGERPRINTS

FIG. 19

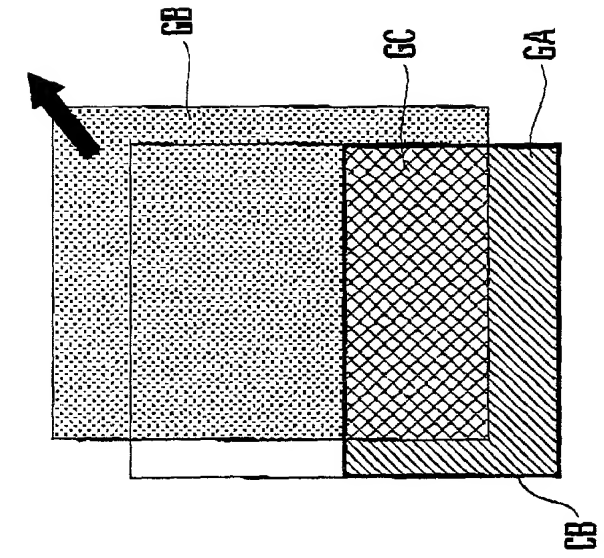


FIG.20B

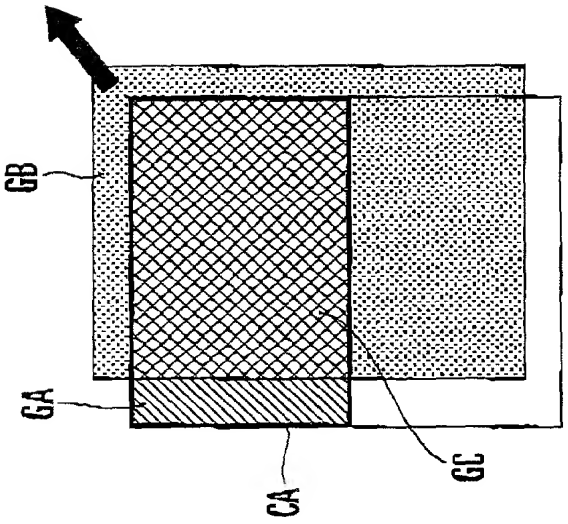


FIG.20A

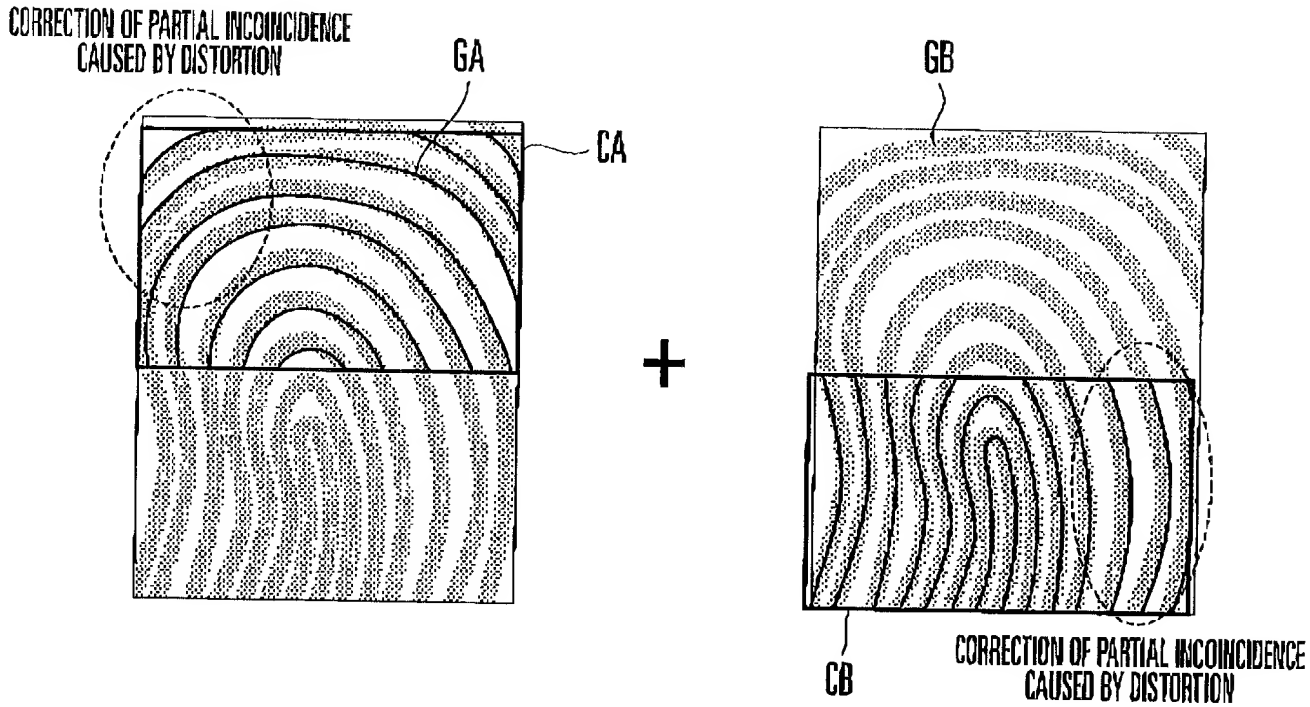


FIG.21A

FIG.21B

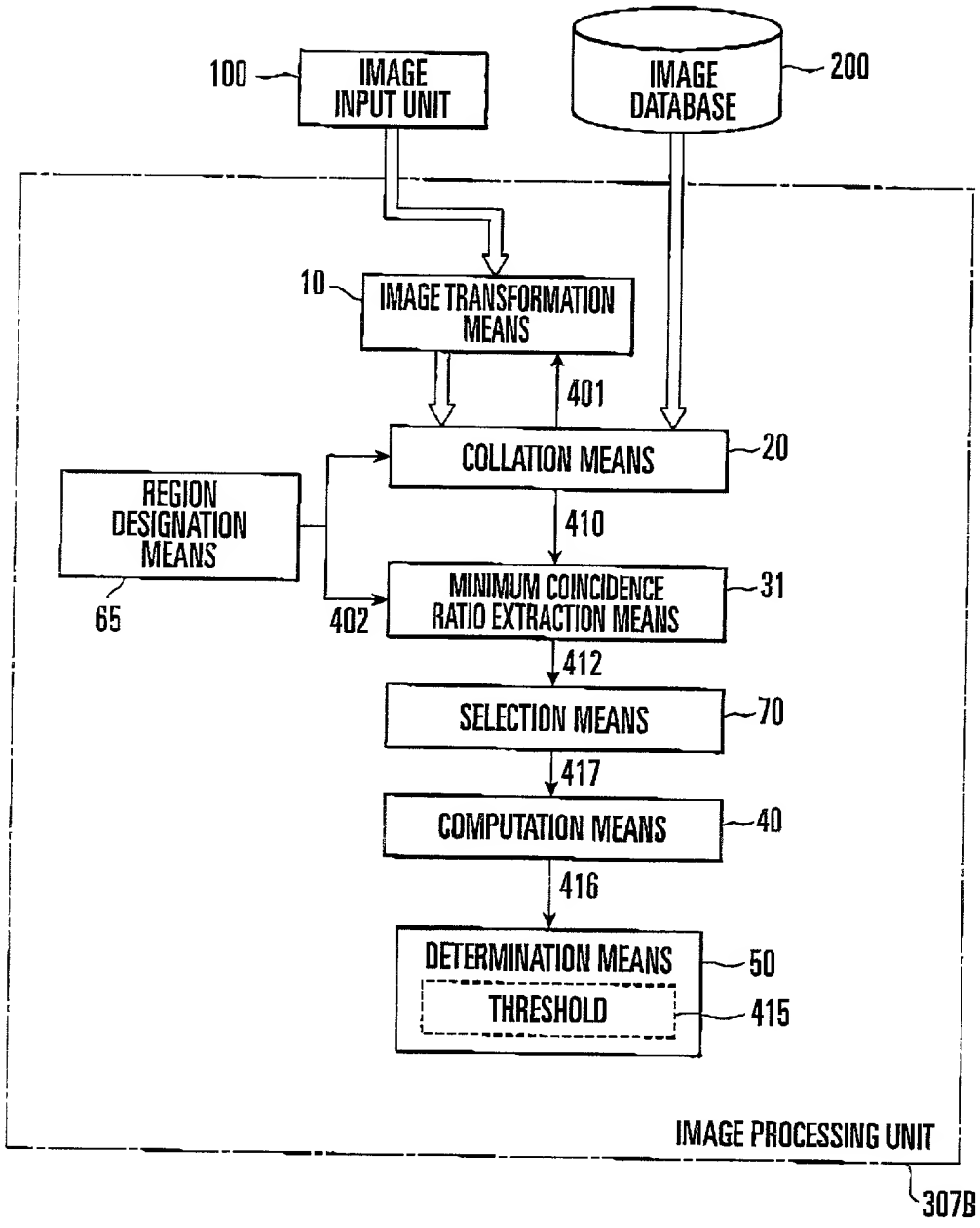

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
10
IMAGE TRANSFORMATION MEANS
401
COLLATION MEANS
20
REGION DESIGNATION MEANS
65
402
410
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
412
SELECTION MEANS
70
417
COMPUTATION MEANS
40
416
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
307B

FIG.22

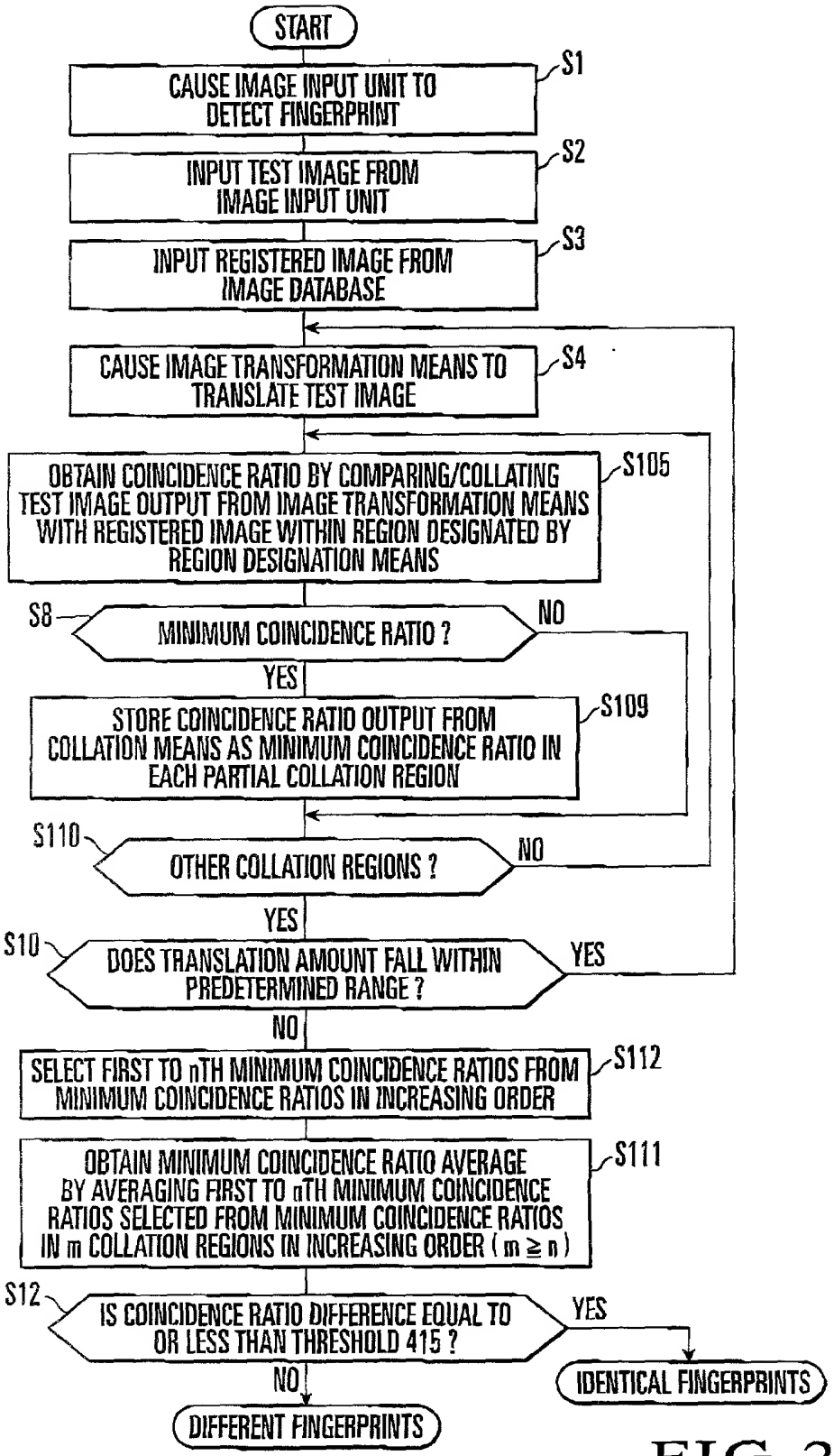

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S4
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE WITHIN REGION DESIGNATED BY REGION DESIGNATION MEANS
S105
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO IN EACH PARTIAL COLLATION REGION
S109
S110
OTHER COLLATION REGIONS ?
NO
YES
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
SELECT FIRST TO nTH MINIMUM COINCIDENCE RATIOS FROM MINIMUM COINCIDENCE RATIOS IN INCREASING ORDER
S112
OBTAIN MINIMUM COINCIDENCE RATIO AVERAGE BY AVERAGING FIRST TO nTH MINIMUM COINCIDENCE RATIOS SELECTED FROM MINIMUM COINCIDENCE RATIOS IN m COLLATION REGIONS IN INCREASING ORDER (m ≧ n)
S111
S12
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR LESS THAN THRESHOLD 415 ?
YES
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG.23

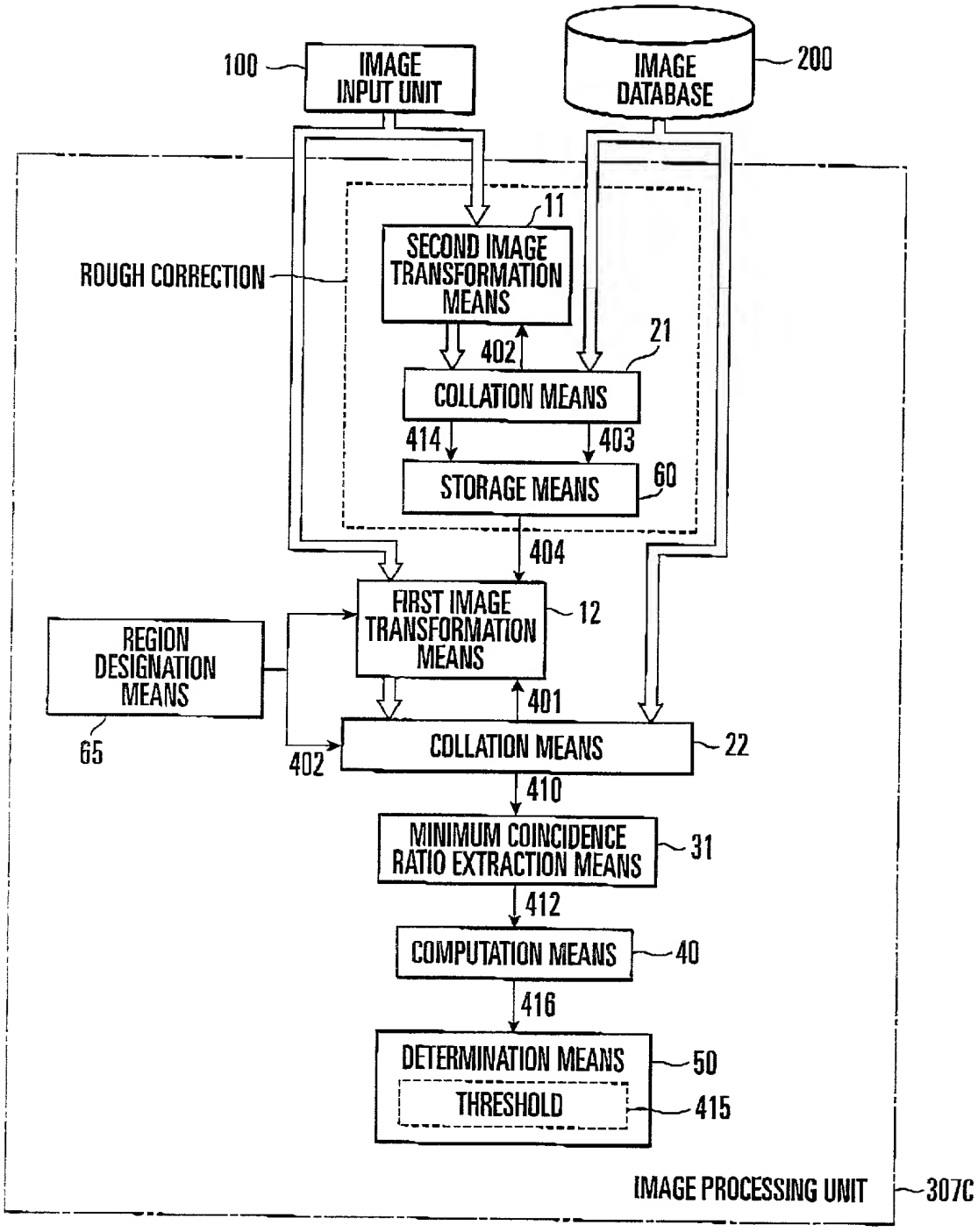

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
11
SECOND IMAGE TRANSFORMATION MEANS
ROUGH CORRECTION
402
21
COLLATION MEANS
414
403
STORAGE MEANS
60
404
FIRST IMAGE TRANSFORMATION MEANS
12
REGION DESIGNATION MEANS
65
401
402
COLLATION MEANS
22
410
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
412
COMPUTATION MEANS
40
416
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
307C

FIG.24

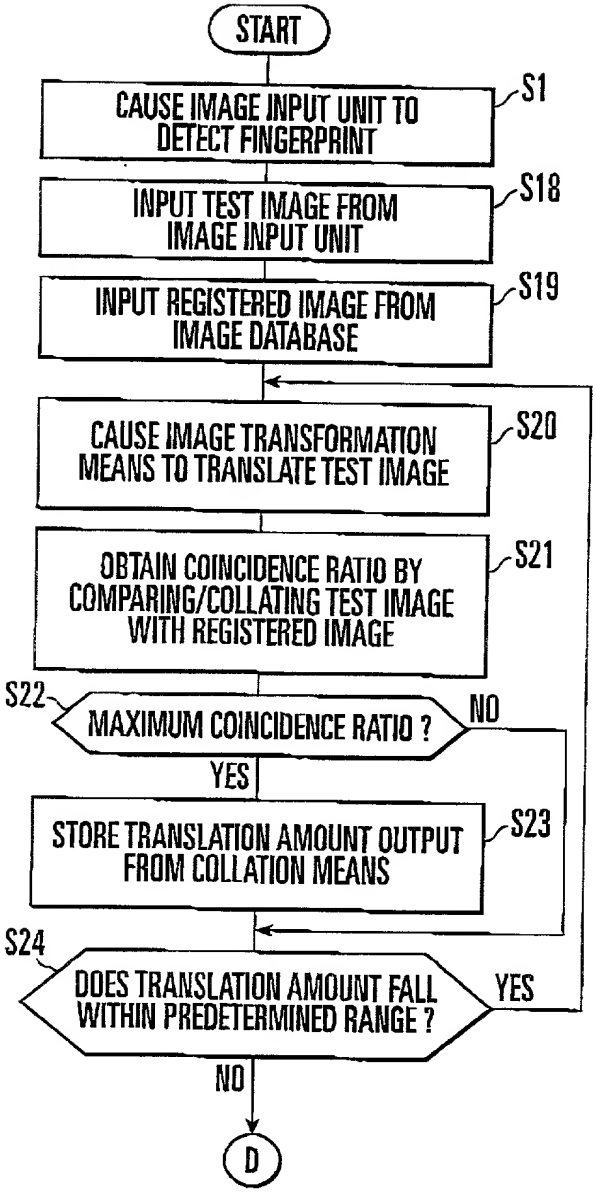

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S18
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S19
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S20
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S21
S22
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE TRANSLATION AMOUNT OUTPUT FROM COLLATION MEANS
S23
S24
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
D

FIG.25A

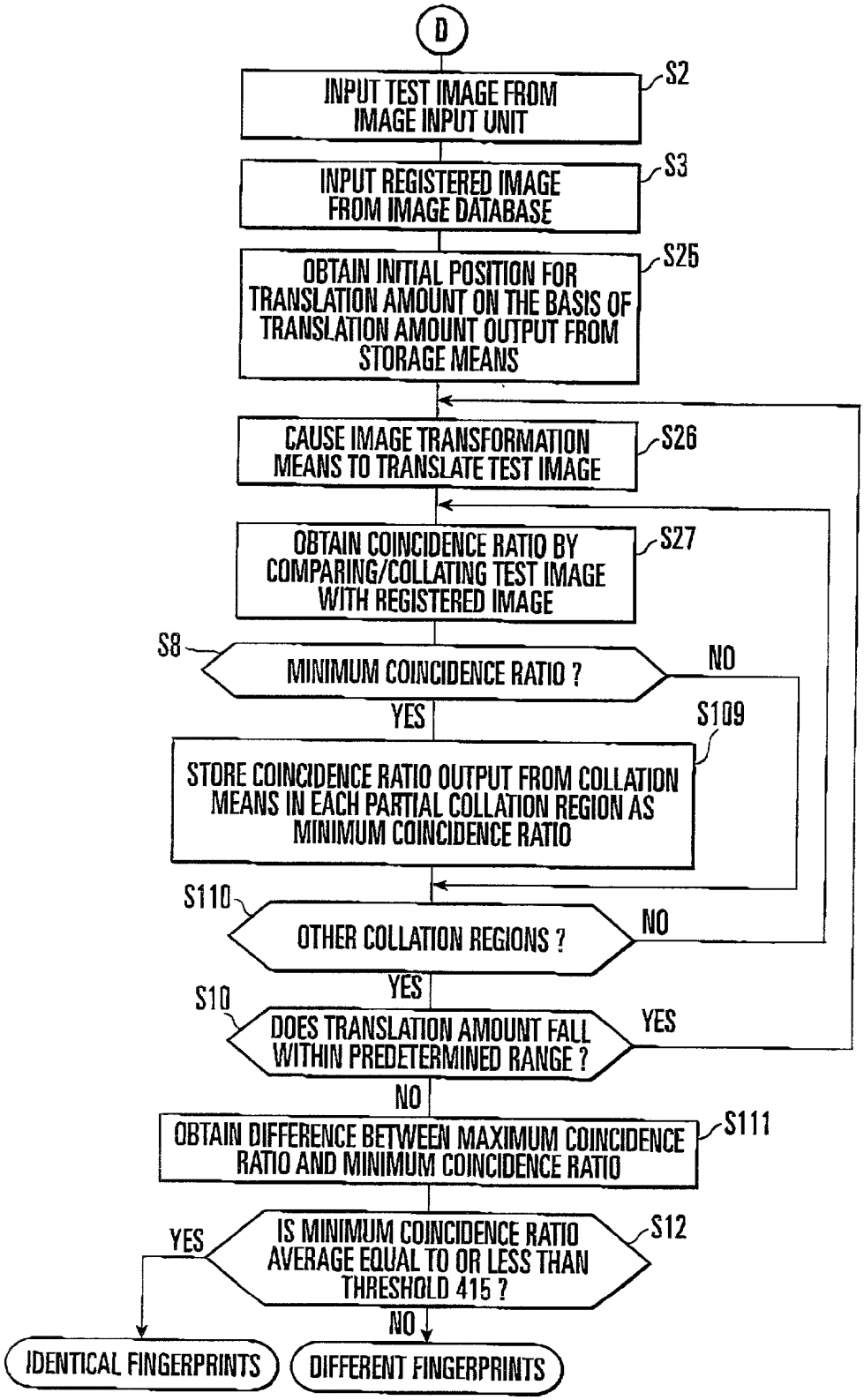

D
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
OBTAIN INITIAL POSITION FOR TRANSLATION AMOUNT ON THE BASIS OF TRANSLATION AMOUNT OUTPUT FROM STORAGE MEANS
S25
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S26
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S27
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
S109
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS IN EACH PARTIAL COLLATION REGION AS MINIMUM COINCIDENCE RATIO
S110
OTHER COLLATION REGIONS ?
NO
YES
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO
S111
YES
IS MINIMUM COINCIDENCE RATIO AVERAGE EQUAL TO OR LESS THAN THRESHOLD 415 ?
S12
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG.25B

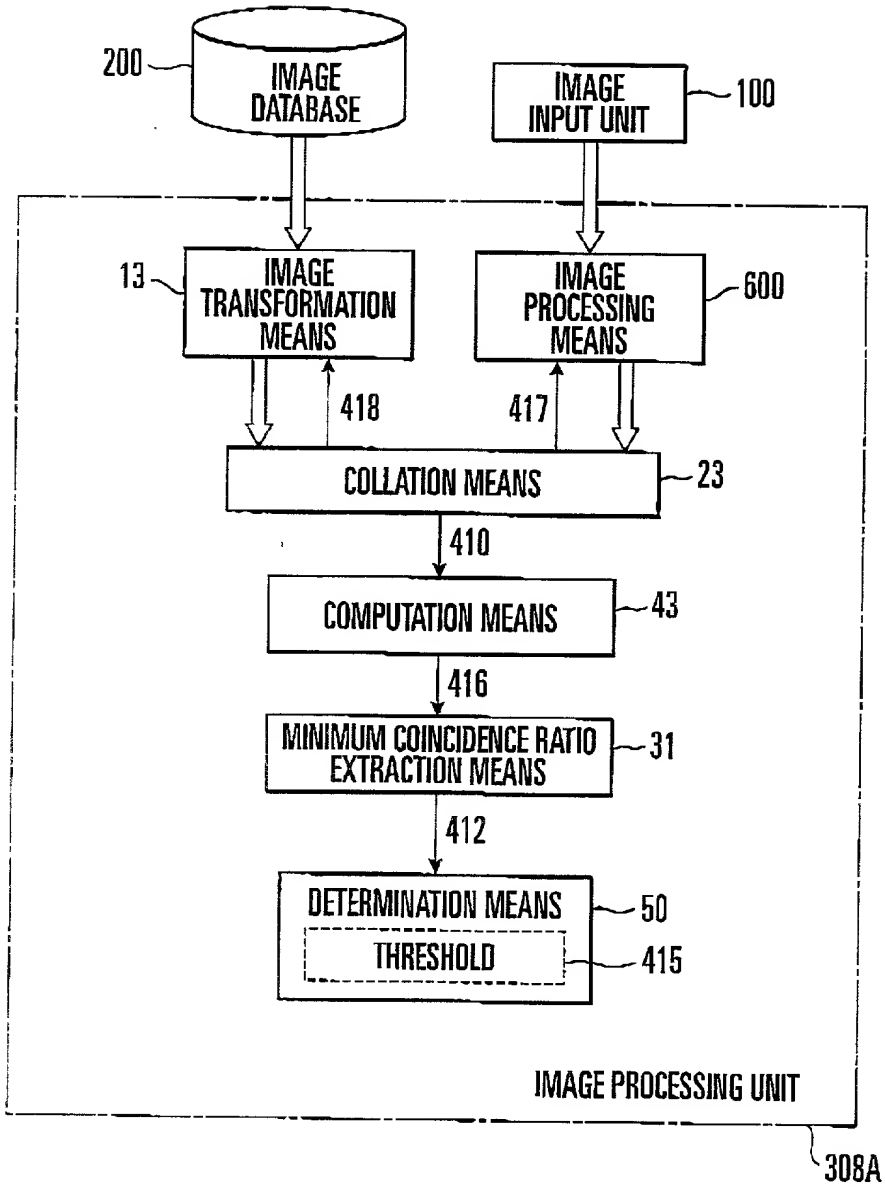

200
IMAGE DATABASE
IMAGE INPUT UNIT
100
13
IMAGE TRANSFORMATION MEANS
IMAGE PROCESSING MEANS
600
418
417
COLLATION MEANS
23
410
COMPUTATION MEANS
43
416
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
412
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
308A

FIG.26

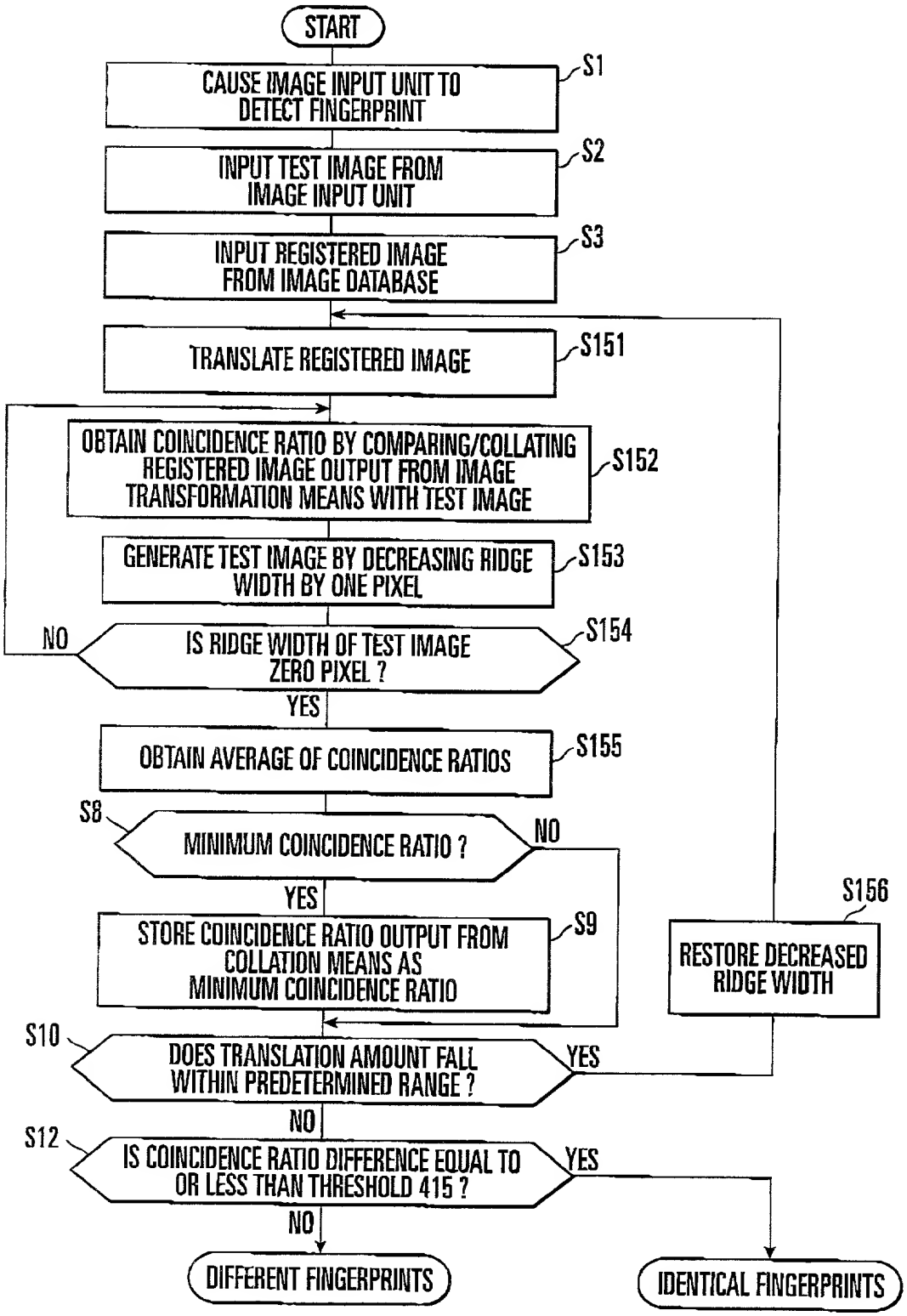
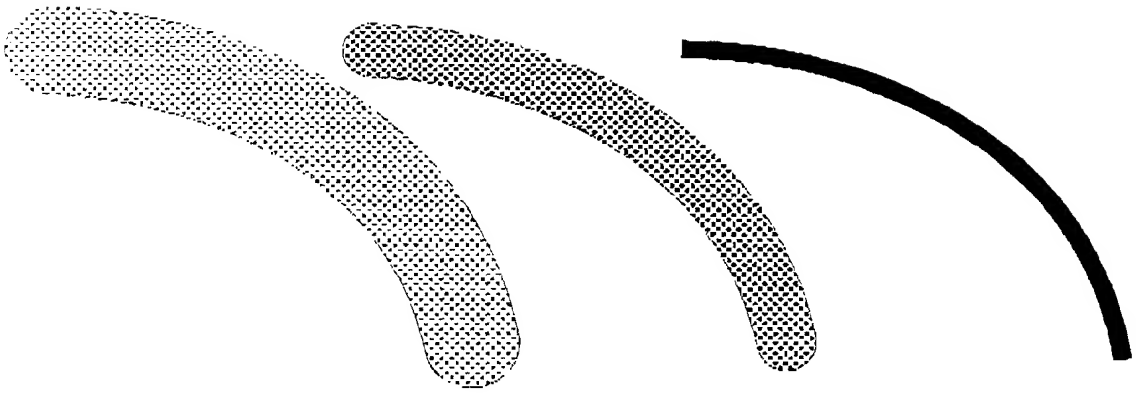

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
TRANSLATE REGISTERED IMAGE
S151
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING REGISTERED IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH TEST IMAGE
S152
GENERATE TEST IMAGE BY DECREASING RIDGE WIDTH BY ONE PIXEL
S153
NO
IS RIDGE WIDTH OF TEST IMAGE ZERO PIXEL ?
S154
YES
OBTAIN AVERAGE OF COINCIDENCE RATIOS
S155
S8
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S156
RESTORE DECREASED RIDGE WIDTH
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
S12
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR LESS THAN THRESHOLD 415 ?
YES
NO
DIFFERENT FINGERPRINTS
IDENTICAL FINGERPRINTS

FIG.27



TEST IMAGE OUTPUT FROM IMAGE INPUT UNIT

TEAT IMAGE OBTAINED BY DECREASING RIDGE WITH USING IMAGE PROCESSING MEANS

TEST IMAGE OBTAINED BY EXECUTING IMAGE PROCESSING MEANS UNTIL RIDGE WIDTH BECOMES ONE PIXEL

FIG.28A FIG.28B FIG.28C

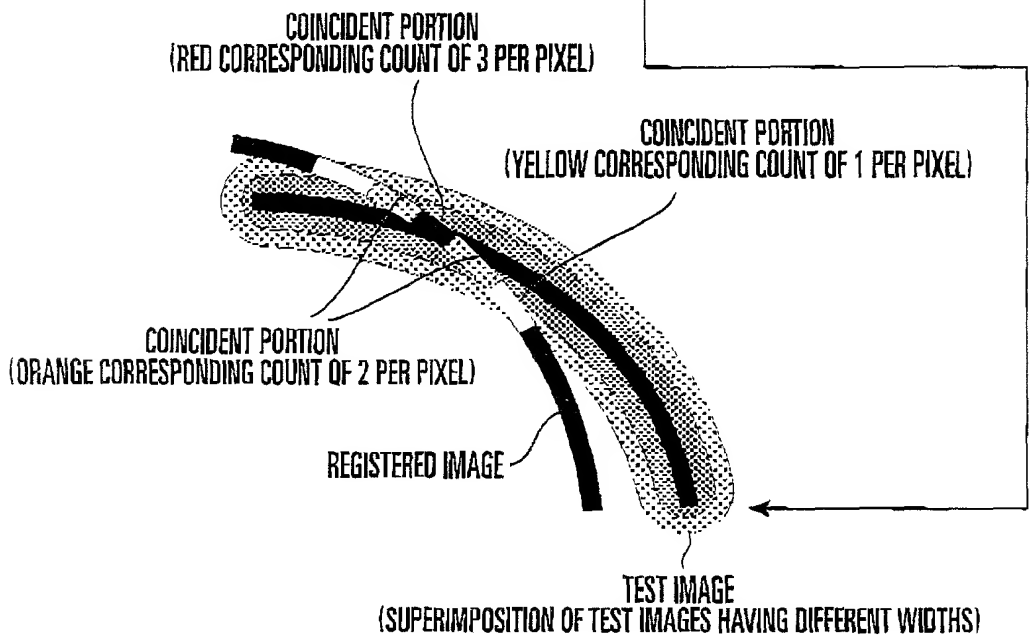


FIG.29

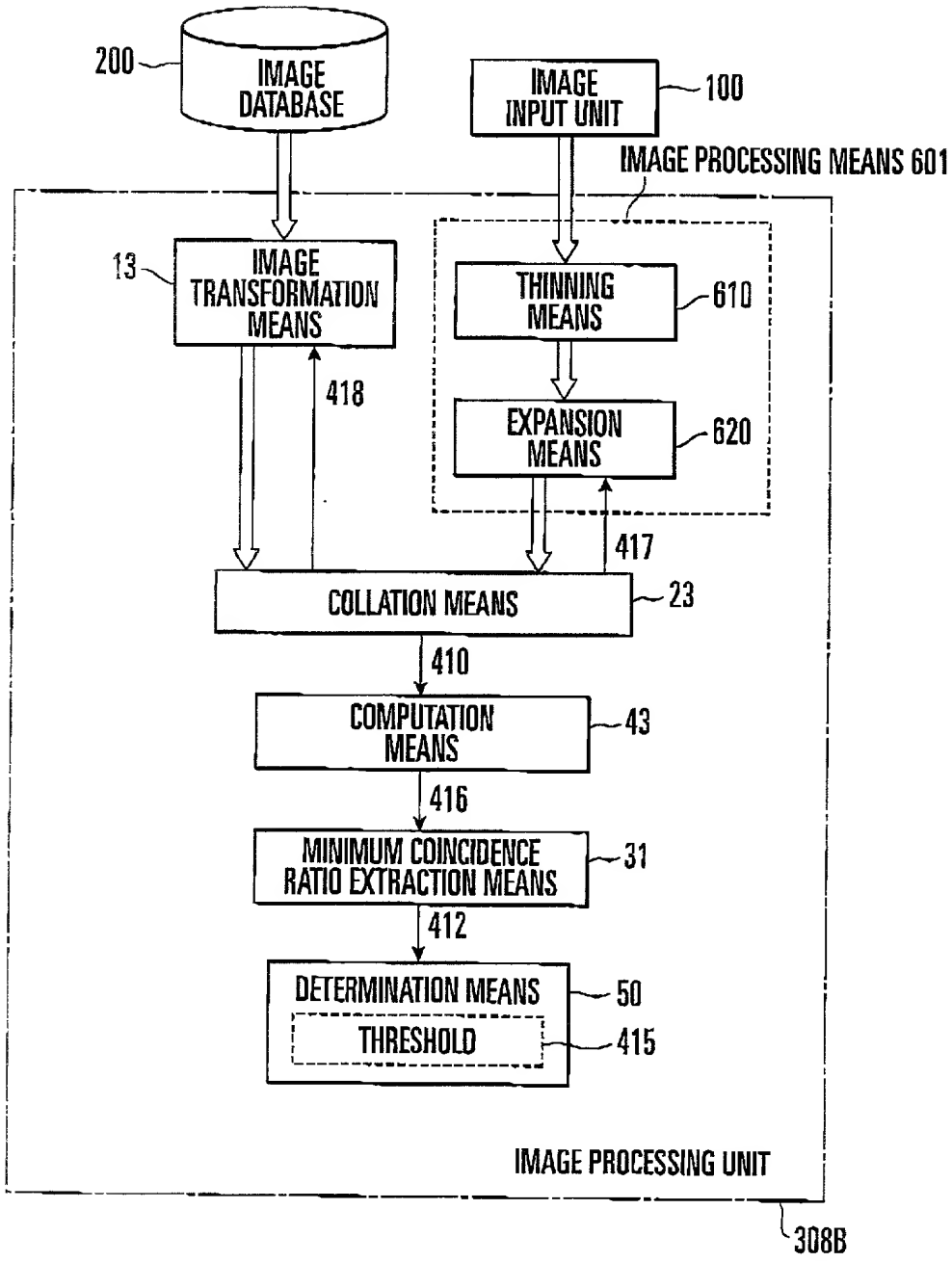

200
IMAGE DATABASE
IMAGE INPUT UNIT
100
IMAGE PROCESSING MEANS 601
13
IMAGE TRANSFORMATION MEANS
418
THINNING MEANS
610
EXPANSION MEANS
620
417
COLLATION MEANS
23
410
COMPUTATION MEANS
43
416
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
412
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
308B

FIG.30

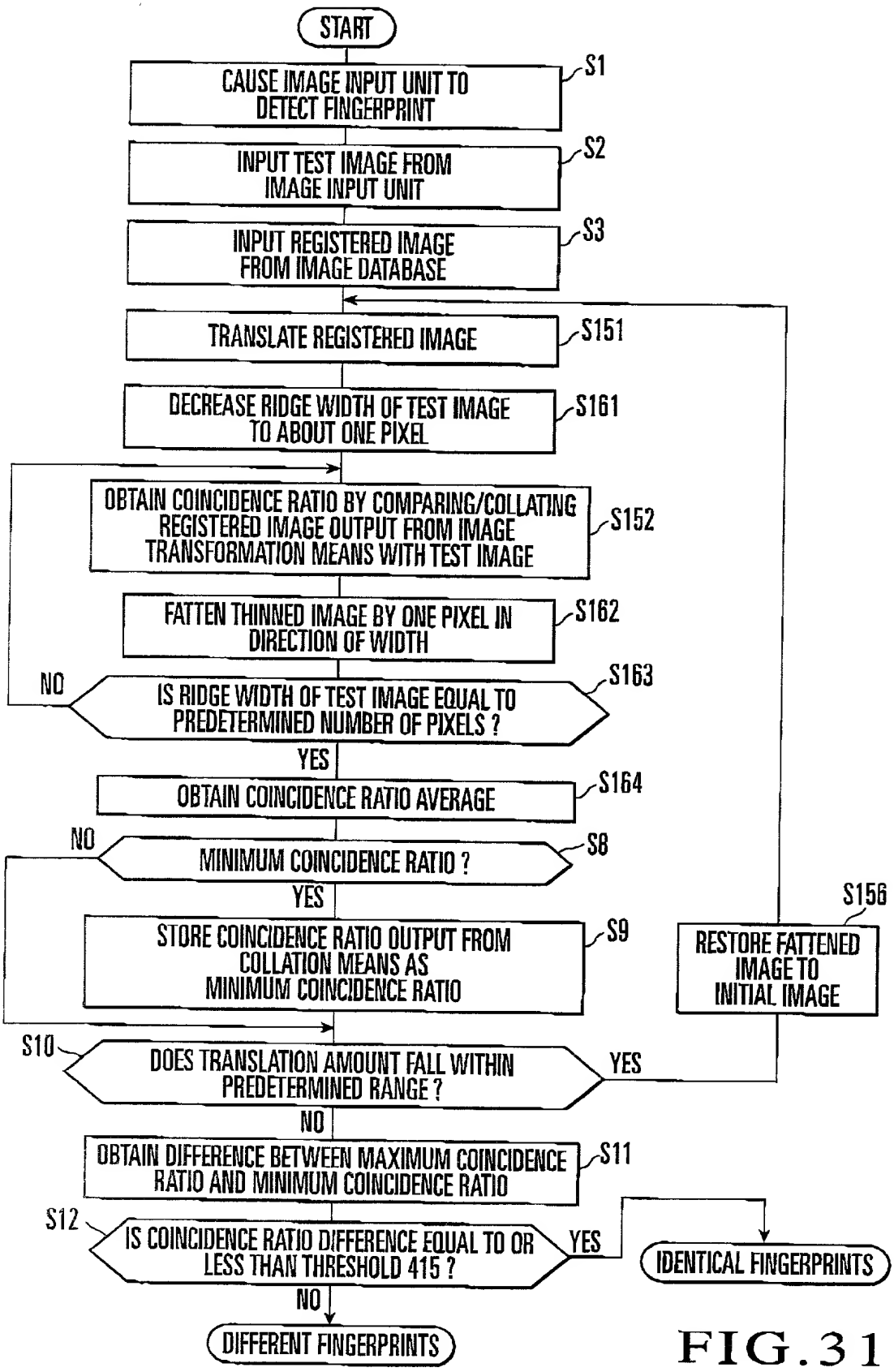


FIG.31

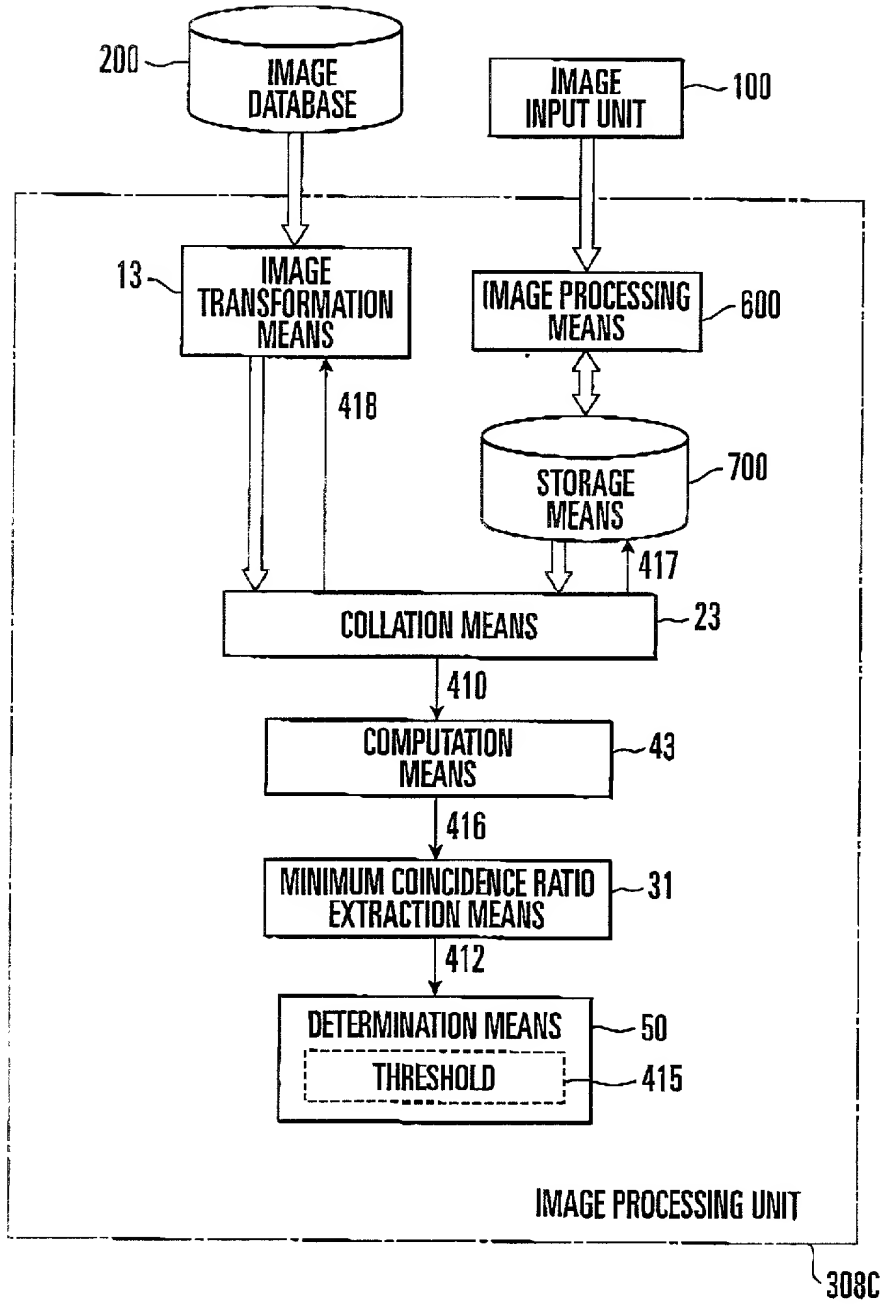

200
IMAGE DATABASE
IMAGE INPUT UNIT
100
13
IMAGE TRANSFORMATION MEANS
IMAGE PROCESSING MEANS
600
418
STORAGE MEANS
700
417
COLLATION MEANS
23
410
COMPUTATION MEANS
43
416
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
31
412
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
308C

FIG.32

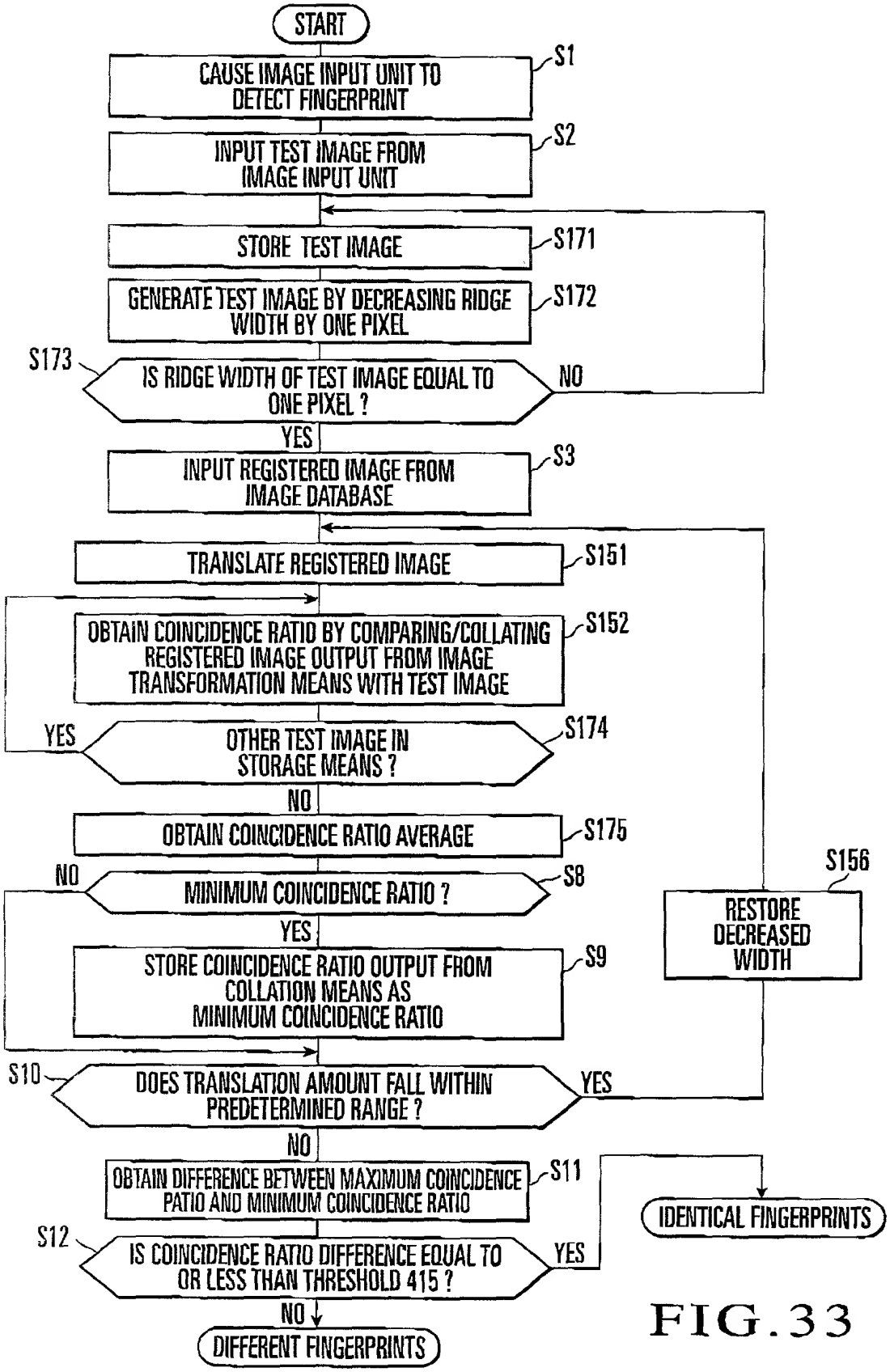

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
STORE TEST IMAGE
S171
GENERATE TEST IMAGE BY DECREASING RIDGE WIDTH BY ONE PIXEL
S172
S173
IS RIDGE WIDTH OF TEST IMAGE EQUAL TO ONE PIXEL ?
NO
YES
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
TRANSLATE REGISTERED IMAGE
S151
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING REGISTERED IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH TEST IMAGE
S152
YES
OTHER TEST IMAGE IN STORAGE MEANS ?
S174
NO
OBTAIN COINCIDENCE RATIO AVERAGE
S175
NO
MINIMUM COINCIDENCE RATIO ?
S8
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S156
RESTORE DECREASED WIDTH
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE PATIO AND MINIMUM COINCIDENCE RATIO
S11
S12
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR LESS THAN THRESHOLD 415 ?
YES
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG. 33

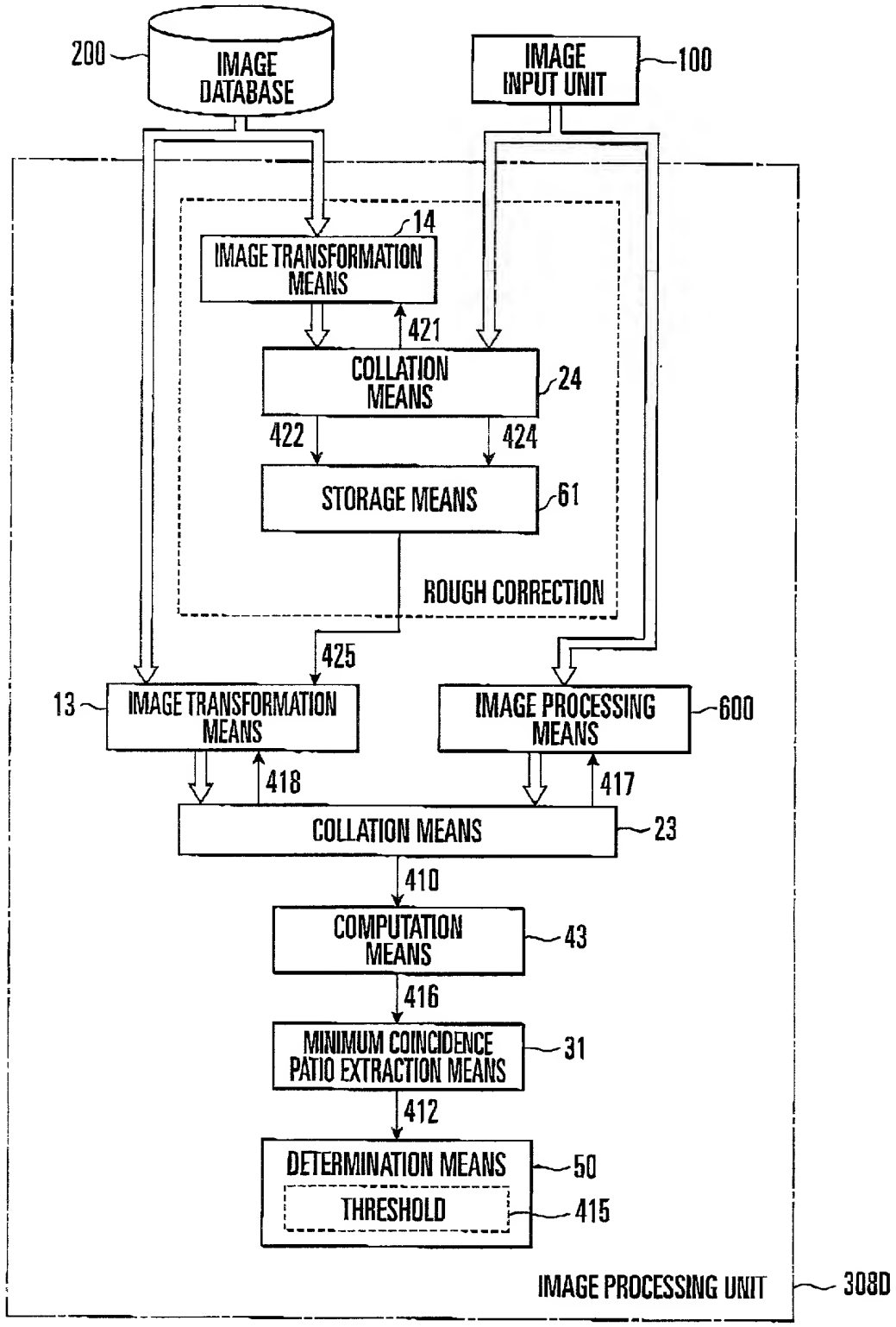

200
IMAGE DATABASE
IMAGE INPUT UNIT
100
14
IMAGE TRANSFORMATION MEANS
421
COLLATION MEANS
24
422
424
STORAGE MEANS
61
ROUGH CORRECTION
425
13
IMAGE TRANSFORMATION MEANS
IMAGE PROCESSING MEANS
600
418
417
COLLATION MEANS
23
410
COMPUTATION MEANS
43
416
MINIMUM COINCIDENCE PATIO EXTRACTION MEANS
31
412
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
308D

FIG.34

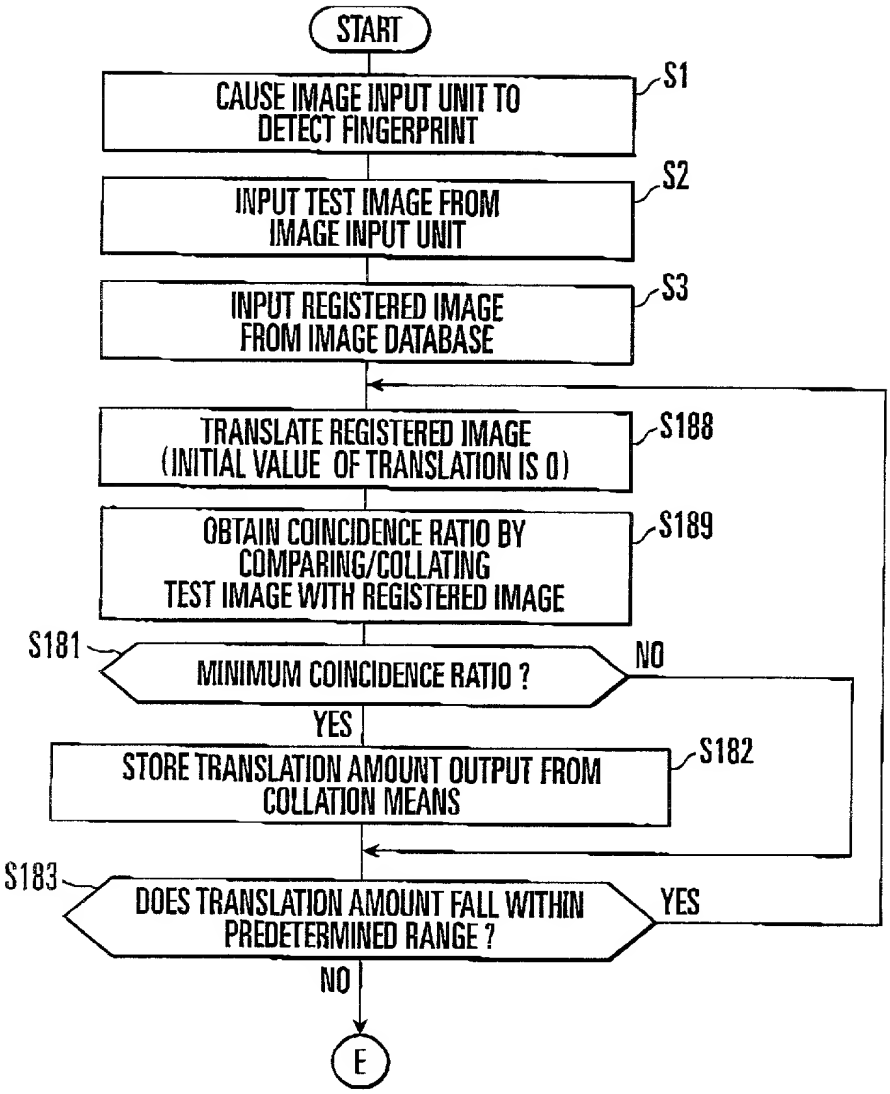

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
TRANSLATE REGISTERED IMAGE (INITIAL VALUE OF TRANSLATION IS 0)
S188
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S189
S181
MINIMUM COINCIDENCE RATIO ?
NO
YES
STORE TRANSLATION AMOUNT OUTPUT FROM COLLATION MEANS
S182
S183
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
E

FIG.35A

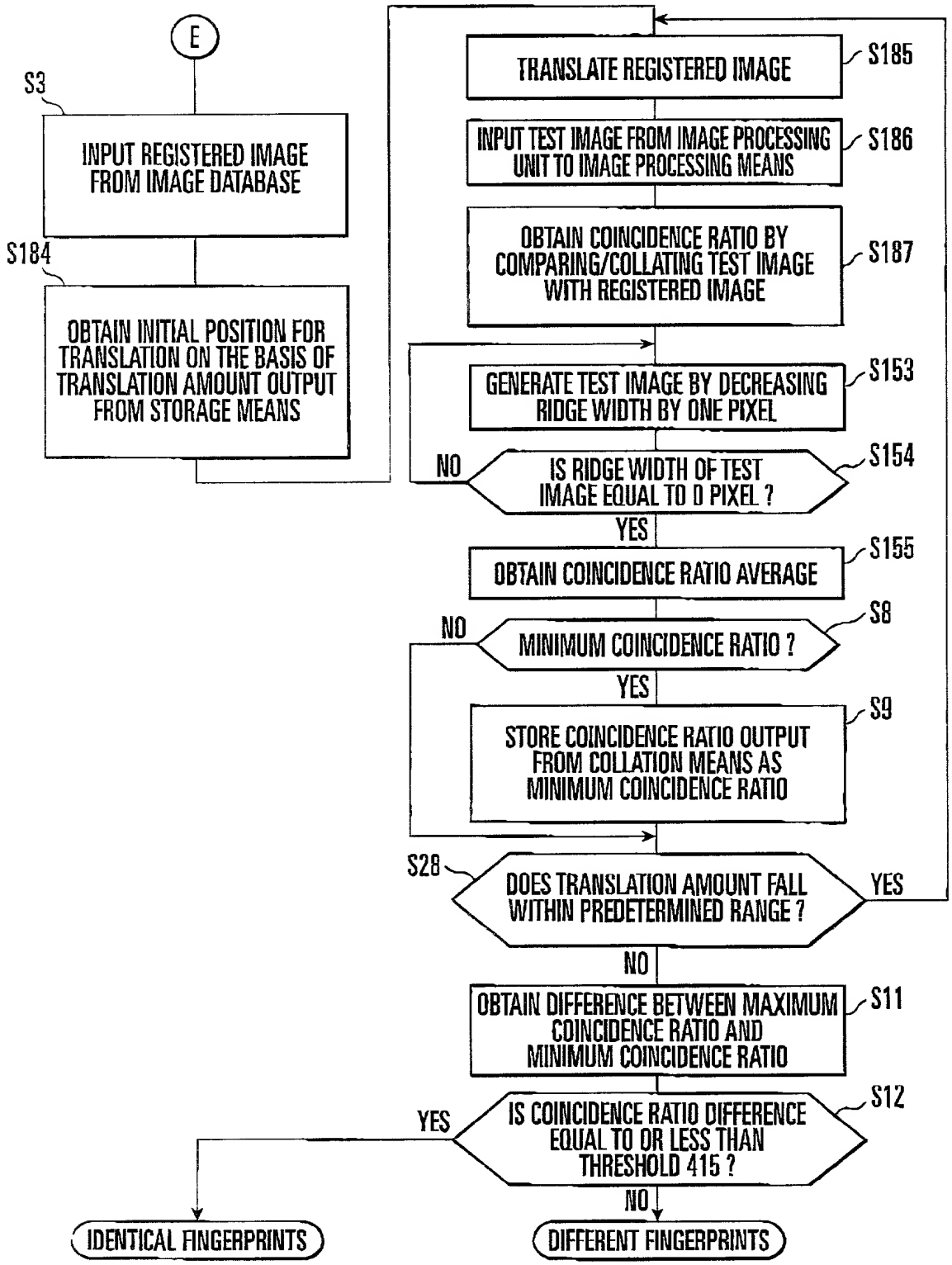

E
S3
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S184
OBTAIN INITIAL POSITION FOR TRANSLATION ON THE BASIS OF TRANSLATION AMOUNT OUTPUT FROM STORAGE MEANS
TRANSLATE REGISTERED IMAGE
S185
INPUT TEST IMAGE FROM IMAGE PROCESSING UNIT TO IMAGE PROCESSING MEANS
S186
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S187
GENERATE TEST IMAGE BY DECREASING RIDGE WIDTH BY ONE PIXEL
S153
NO
IS RIDGE WIDTH OF TEST IMAGE EQUAL TO 0 PIXEL ?
S154
YES
OBTAIN COINCIDENCE RATIO AVERAGE
S155
NO
MINIMUM COINCIDENCE RATIO ?
S8
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO
S9
S28
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
OBTAIN DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO
S11
YES
IS COINCIDENCE RATIO DIFFERENCE EQUAL TO OR LESS THAN THRESHOLD 415 ?
S12
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG.35B

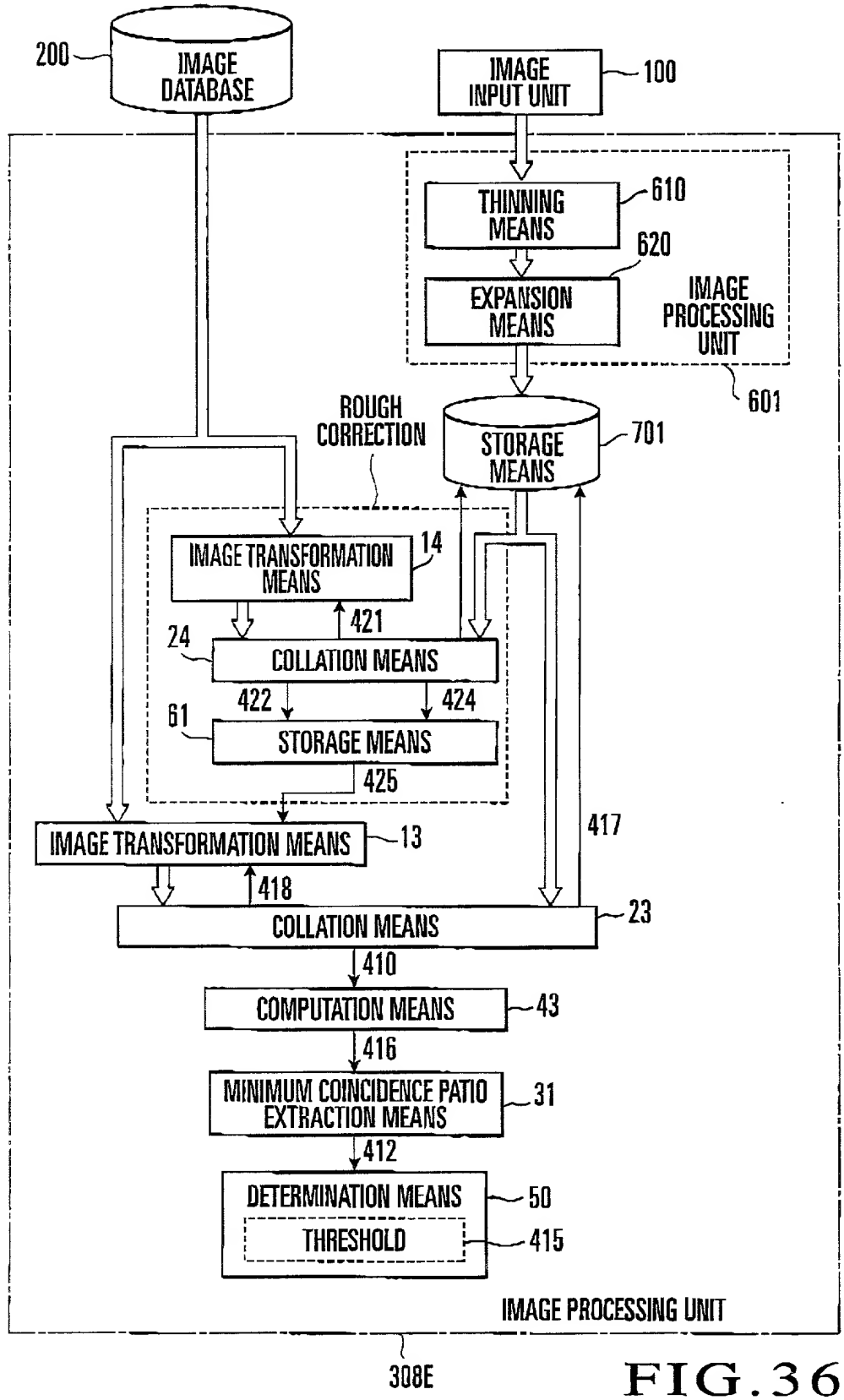

200
IMAGE DATABASE
IMAGE INPUT UNIT
100
THINNING MEANS
610
620
EXPANSION MEANS
IMAGE PROCESSING UNIT
601
ROUGH CORRECTION
STORAGE MEANS
701
IMAGE TRANSFORMATION MEANS
14
421
24
COLLATION MEANS
422
424
61
STORAGE MEANS
425
IMAGE TRANSFORMATION MEANS
13
417
418
COLLATION MEANS
23
410
COMPUTATION MEANS
43
416
MINIMUM COINCIDENCE PATIO EXTRACTION MEANS
31
412
DETERMINATION MEANS
50
THRESHOLD
415
IMAGE PROCESSING UNIT
308E

FIG.36

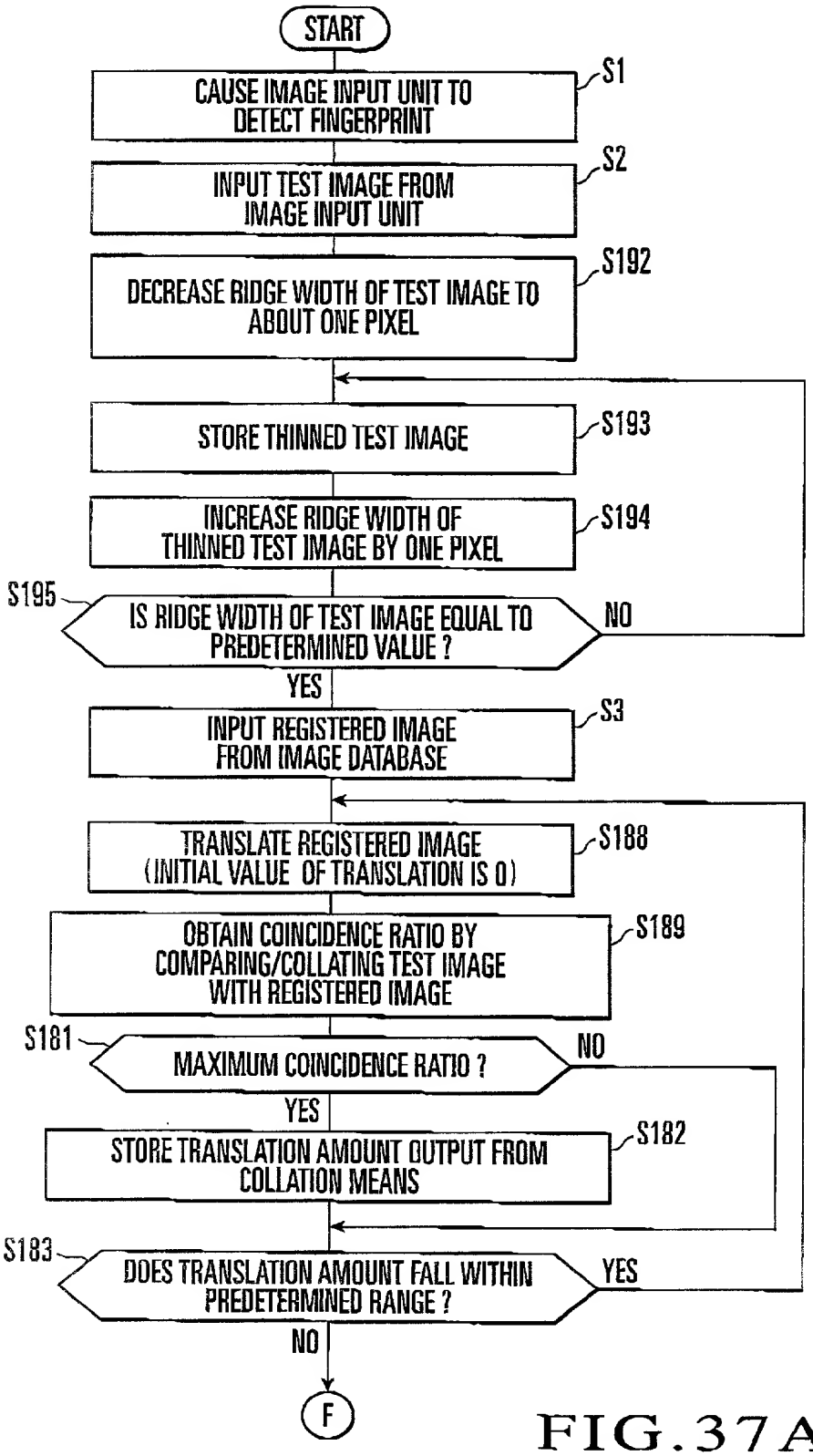

START
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S1
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S2
DECREASE RIDGE WIDTH OF TEST IMAGE TO ABOUT ONE PIXEL
S192
STORE THINNED TEST IMAGE
S193
INCREASE RIDGE WIDTH OF THINNED TEST IMAGE BY ONE PIXEL
S194
S195
IS RIDGE WIDTH OF TEST IMAGE EQUAL TO PREDETERMINED VALUE ?
NO
YES
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S3
TRANSLATE REGISTERED IMAGE (INITIAL VALUE OF TRANSLATION IS 0)
S188
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE WITH REGISTERED IMAGE
S189
S181
MAXIMUM COINCIDENCE RATIO ?
NO
YES
STORE TRANSLATION AMOUNT OUTPUT FROM COLLATION MEANS
S182
S183
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
F

FIG.37A

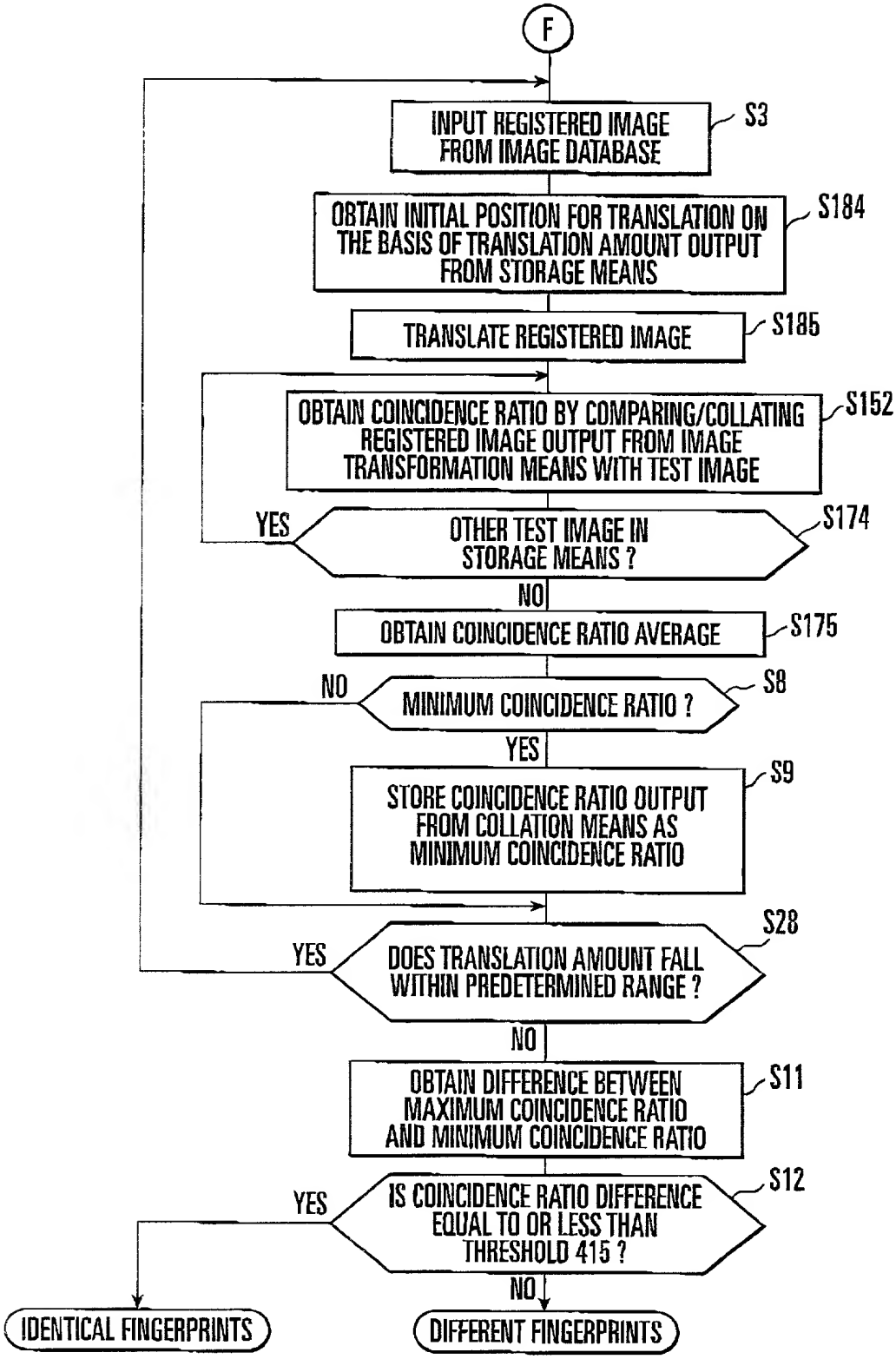


FIG.37B

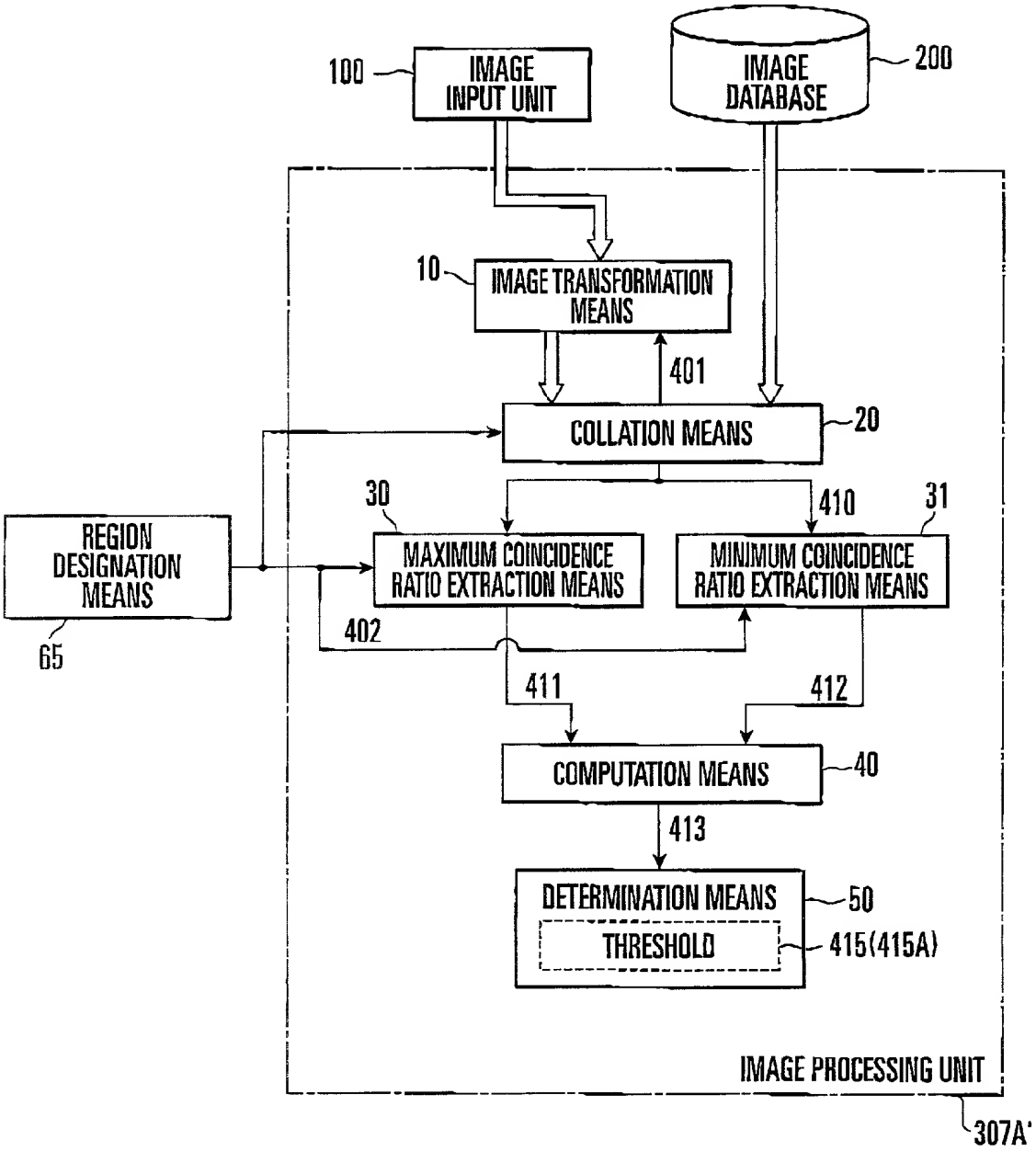

100
IMAGE INPUT UNIT
IMAGE DATABASE
200
10
IMAGE TRANSFORMATION MEANS
401
COLLATION MEANS
20
30
410
31
REGION DESIGNATION MEANS
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
65
402
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415(415A)
IMAGE PROCESSING UNIT
307A'

FIG.38

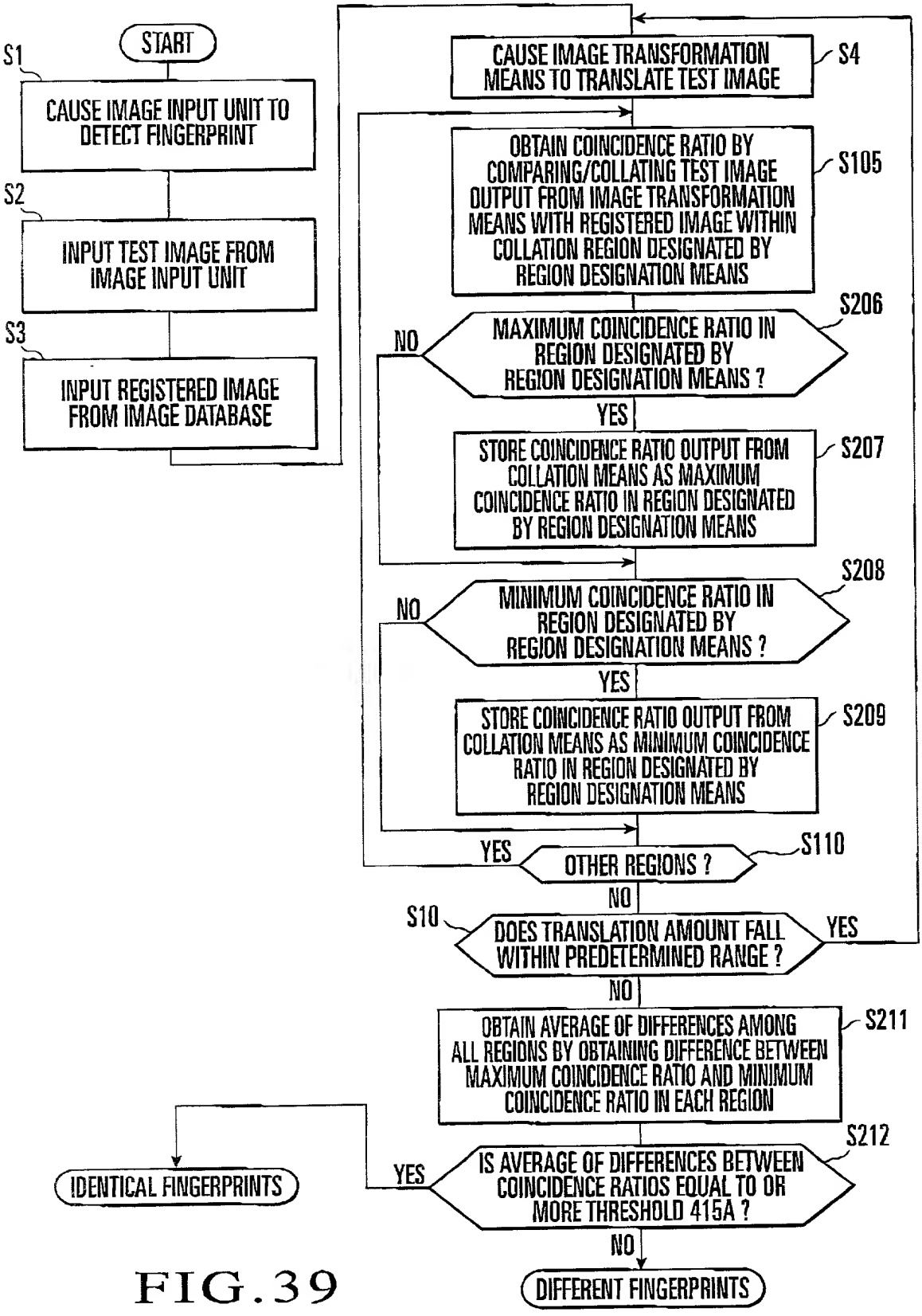

START
S1
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S2
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S3
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S4
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
S105
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE WITHIN COLLATION REGION DESIGNATED BY REGION DESIGNATION MEANS
S206
MAXIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS ?
NO
YES
S207
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MAXIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS
S208
MINIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS ?
NO
YES
S209
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS
S110
OTHER REGIONS ?
YES
NO
S10
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
YES
NO
S211
OBTAIN AVERAGE OF DIFFERENCES AMONG ALL REGIONS BY OBTAINING DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO IN EACH REGION
S212
IS AVERAGE OF DIFFERENCES BETWEEN COINCIDENCE RATIOS EQUAL TO OR MORE THRESHOLD 415A ?
YES
NO
IDENTICAL FINGERPRINTS
DIFFERENT FINGERPRINTS

FIG.39

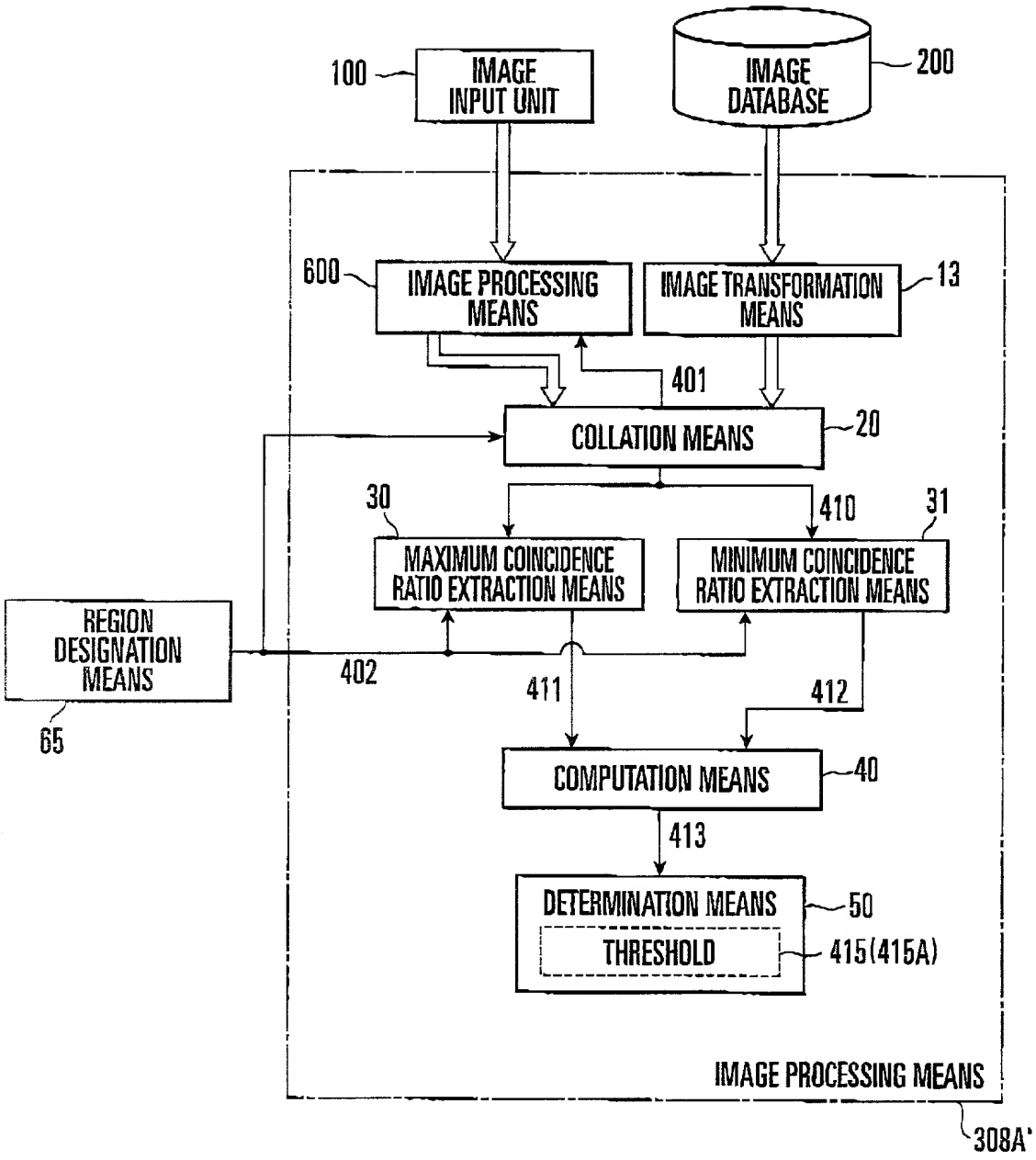

100
IMAGE INPUT UNIT
200
IMAGE DATABASE
600
IMAGE PROCESSING MEANS
IMAGE TRANSFORMATION MEANS
13
401
COLLATION MEANS
20
30
410
31
MAXIMUM COINCIDENCE RATIO EXTRACTION MEANS
MINIMUM COINCIDENCE RATIO EXTRACTION MEANS
REGION DESIGNATION MEANS
65
402
411
412
COMPUTATION MEANS
40
413
DETERMINATION MEANS
50
THRESHOLD
415(415A)
IMAGE PROCESSING MEANS
308A'

FIG.40

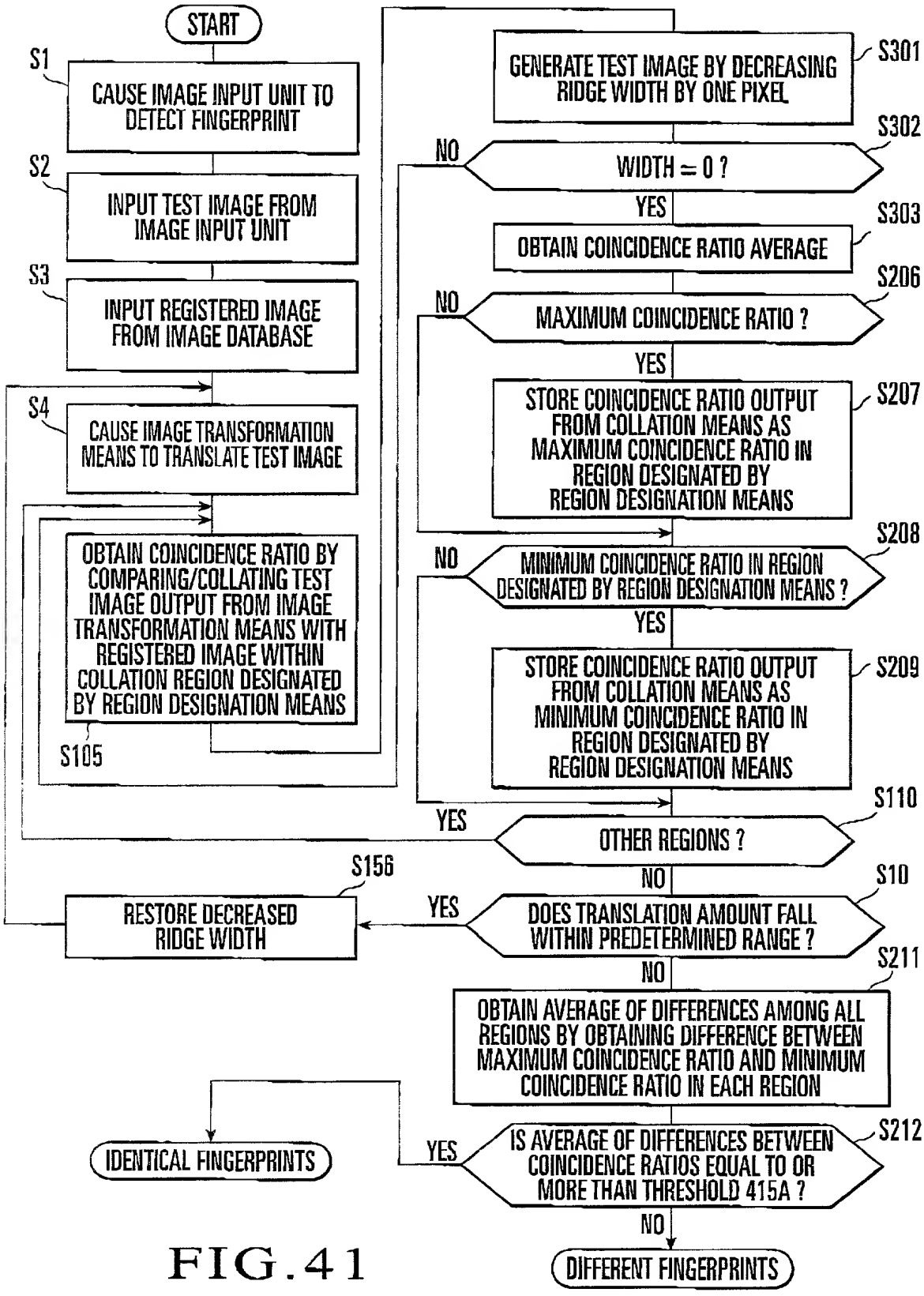

START
S1
CAUSE IMAGE INPUT UNIT TO DETECT FINGERPRINT
S2
INPUT TEST IMAGE FROM IMAGE INPUT UNIT
S3
INPUT REGISTERED IMAGE FROM IMAGE DATABASE
S4
CAUSE IMAGE TRANSFORMATION MEANS TO TRANSLATE TEST IMAGE
OBTAIN COINCIDENCE RATIO BY COMPARING/COLLATING TEST IMAGE OUTPUT FROM IMAGE TRANSFORMATION MEANS WITH REGISTERED IMAGE WITHIN COLLATION REGION DESIGNATED BY REGION DESIGNATION MEANS
S105
GENERATE TEST IMAGE BY DECREASING RIDGE WIDTH BY ONE PIXEL
S301
NO
WIDTH = 0 ?
S302
YES
OBTAIN COINCIDENCE RATIO AVERAGE
S303
NO
MAXIMUM COINCIDENCE RATIO ?
S206
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MAXIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS
S207
NO
MINIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS ?
S208
YES
STORE COINCIDENCE RATIO OUTPUT FROM COLLATION MEANS AS MINIMUM COINCIDENCE RATIO IN REGION DESIGNATED BY REGION DESIGNATION MEANS
S209
YES
OTHER REGIONS ?
S110
NO
DOES TRANSLATION AMOUNT FALL WITHIN PREDETERMINED RANGE ?
S10
YES
RESTORE DECREASED RIDGE WIDTH
S156
NO
OBTAIN AVERAGE OF DIFFERENCES AMONG ALL REGIONS BY OBTAINING DIFFERENCE BETWEEN MAXIMUM COINCIDENCE RATIO AND MINIMUM COINCIDENCE RATIO IN EACH REGION
S211
IS AVERAGE OF DIFFERENCES BETWEEN COINCIDENCE RATIOS EQUAL TO OR MORE THAN THRESHOLD 415A ?
S212
YES
IDENTICAL FINGERPRINTS
NO
DIFFERENT FINGERPRINTS

FIG.41

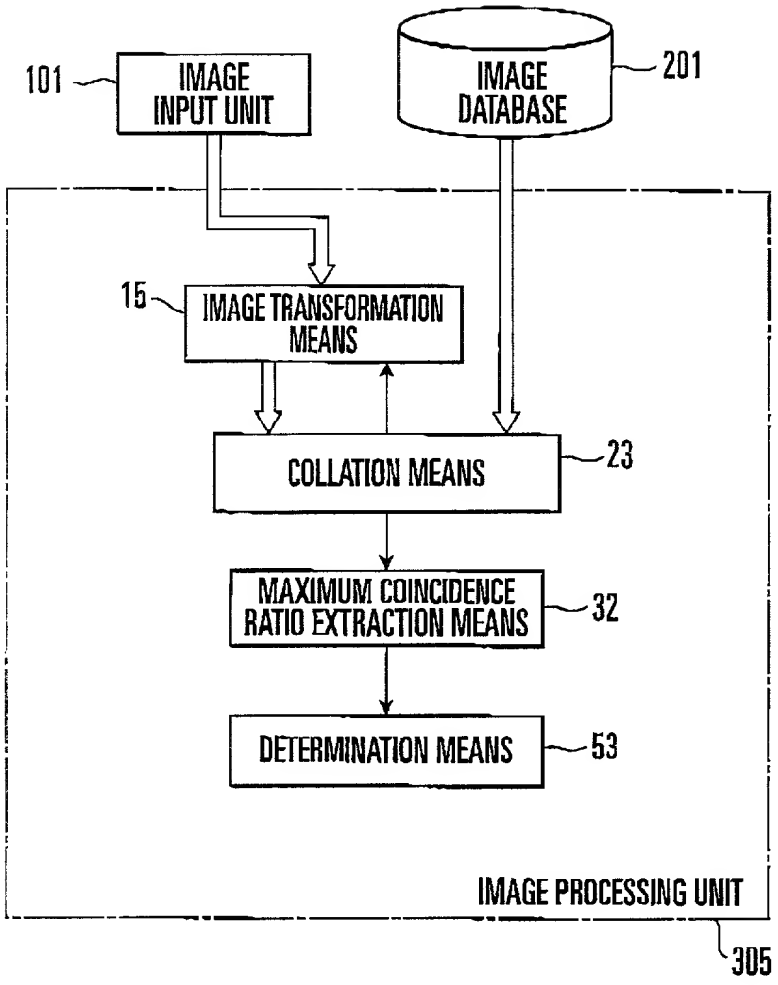


FIG.42
PRIOR ART

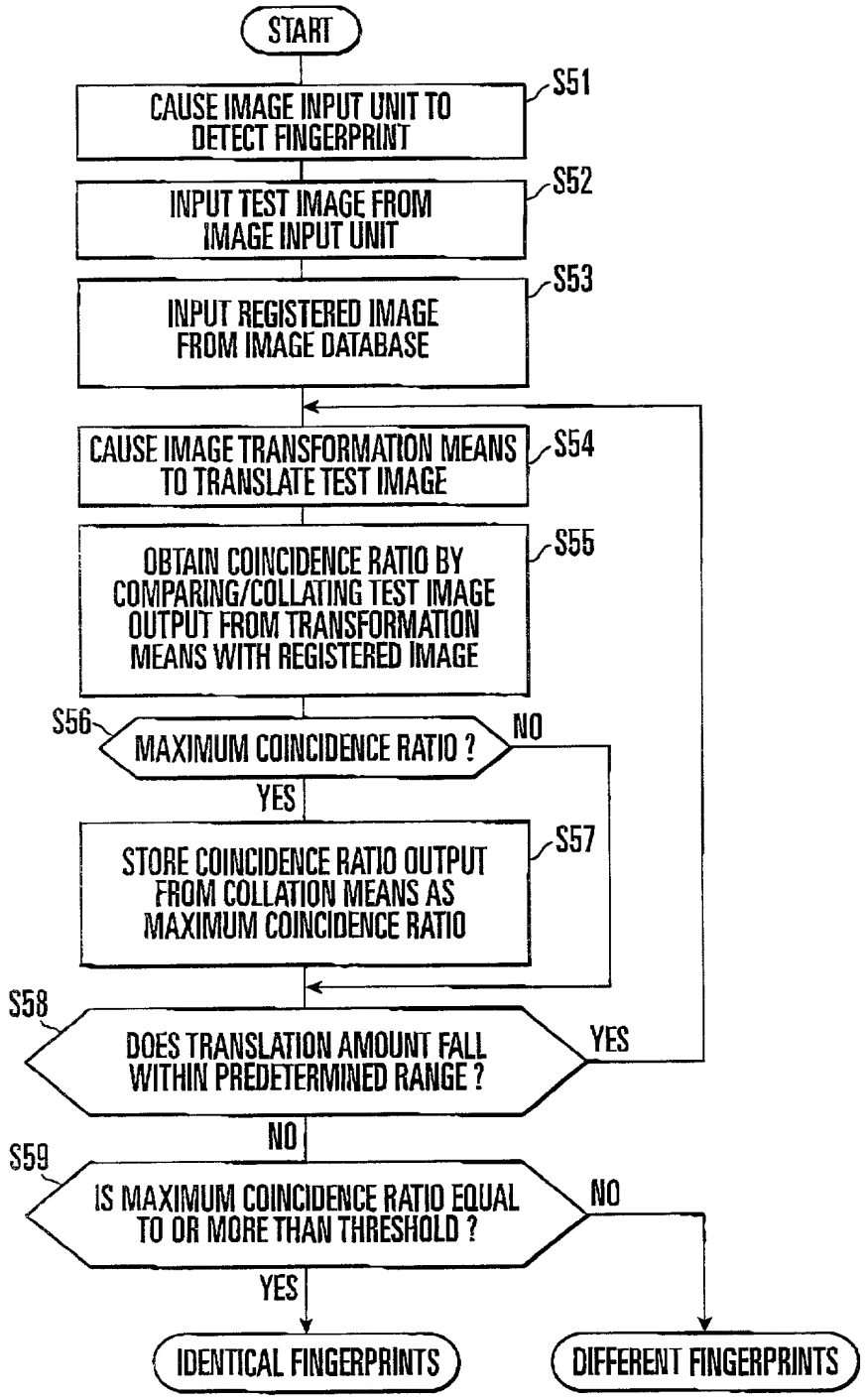


FIG.43
PRIOR ART